A Scranton Gillette Publication

MAY 1959

WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL

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Small foundation surfaces, dictated by mines, plus unusual wet and dry weather flow conditions are encountered at this Duisburg, Germany digester installation. Story on page 213.

See Page 213 For Report on Wastewater in Germany

Horse and buggy transportation in the jet age...

When rapidly increasing population and industrial demands are making water consumption *soar like a jet*, are your water officials forced to go along, horse and buggy fashion, with facilities designed to accommodate a previous generation?

If so, your most immediate needs are new and bigger pipe lines to supplement the old and to replace the obsolete. LOCK JOINT CONCRETE PRESSURE PIPE is the ideal material to implement this important program. Its durability and dependability assure trouble-free service for generations to come. Its initial high carrying capacity is a permanent feature, permitting accurate, long-range estimates of available supply in the distant future.

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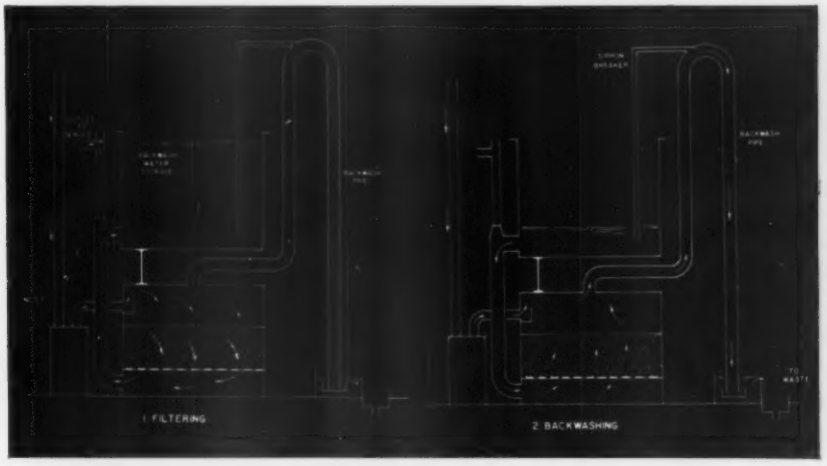
the know-how
the equipment
and the experience
for solving problems involving fluids

Permutit valveless filter, municipal design



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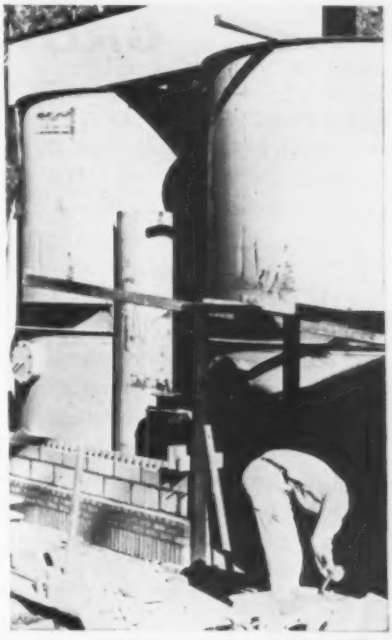
Address yourself to our Permutit Division, Department WS-59, 50 West 44th Street, New York 36, New York.



Automatic valveless gravity filters, like this tandem setup photographed during its installation at an Eastern municipality, are now in service.

Four-inch F&P magnetic flowmeter measuring influent from the grinder at the Gainesway Subdivision Sewage Treatment Plant, Lexington, Kentucky. Accuracy is unaffected by piping configurations or valve placement. Consulting engineer: Marion C. Welch, Lexington, Kentucky.

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FP FISCHER & PORTER COMPANY *INSTRUMENTATION AND CHLORINATION*

Vol. 106 No. 5

MAY • 1959

A Scranton Gillette Publication

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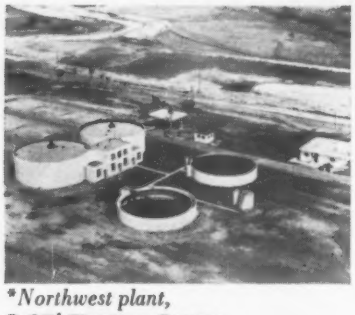

*Northwest plant,
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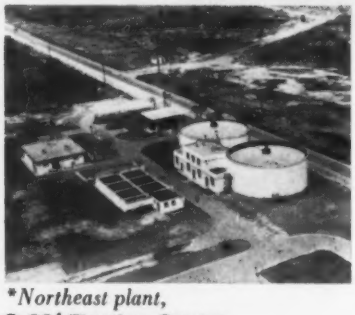
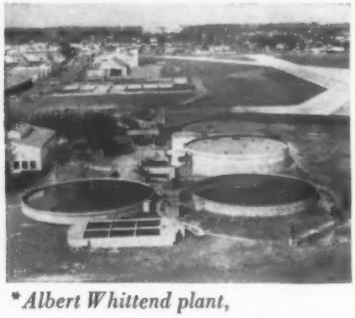
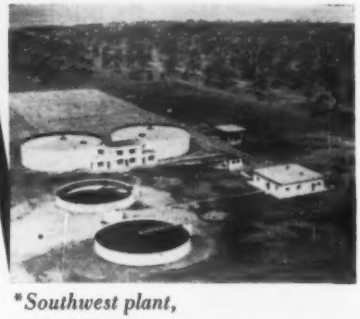


*Northeast plant,
2-60′ Floating Covers



*Albert Whittend plant,
2-100′ Floating Covers



*Southwest plant,
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Briefs

Blower Characteristics, Selection and Maintenance are discussed by an authority in the field in such a way as to provide basic background information on the subject—page 185.

Odor Removal, a new method involving the use of fatty oils, is discussed here in this, the first of two articles dealing with the removal of taste and odor—page 188.

Meters Solve Water Crisis shown how the effective use of meters can correct a difficult situation—page 191.

Water Works Practice #44 is the beginning of the long awaited continuation of Dr. Symons series—this installment takes up using the lecture approach to water softening—page 193.

Management Symposium—Part III Physical Operating Data, Customer and Public Relations and prospects for the future are discussed by leading waterworks men—page 199.

Desanding Municipal Water Supplies discusses in detail how the sand problem was overcome in a progressive modern city plagued with the usual growing pains—page 206.

Operation Helpmeet discussing the doings at the first meeting of the second half century of the Indiana Section AWWA—page 208.

50 years of Progress—the golden anniversary meeting of the Illinois Section AWWA—page 210.

Maintaining Water Supplies at zero temperature provides a rapid method for determining the rate of flow needed to prevent freezing—page 212.

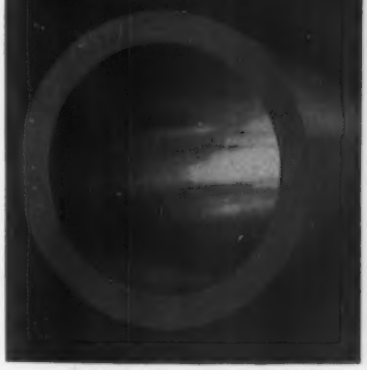
Wastewater Technology in Germany is continued in this second part which details secondary treatment and sludge digestion.—page 213.

Elements of Sludge Digestion presents basic material on sludge digestion as collected for use in lecturing to a short course for sewage treatment works operators. We feel that it will be of particular help to the new or less experienced treatment works operator.—page 219.

Dear Bill. In this letter Cliff discusses his views on instituting demand charges to get rid of the water "free-loaders"—page 224.

quality pipe from a quality producer

Byers PVC Pipe scotches corrosion



where to use it:
- raw sewage lines
- sewage gas lines from digestors
- sludge lines
- chemical treating lines such as:
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  ferric sulfate lines
  ferrous sulfate lines
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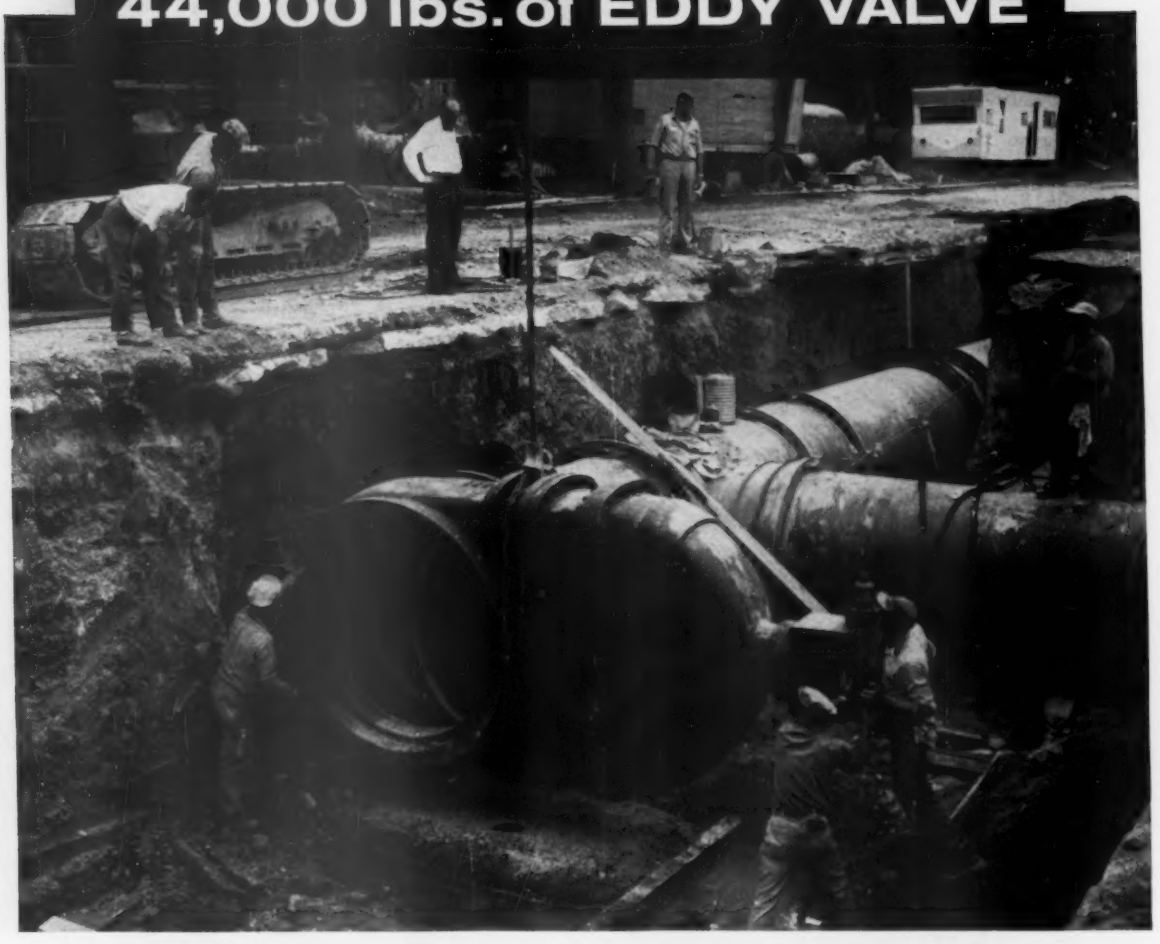
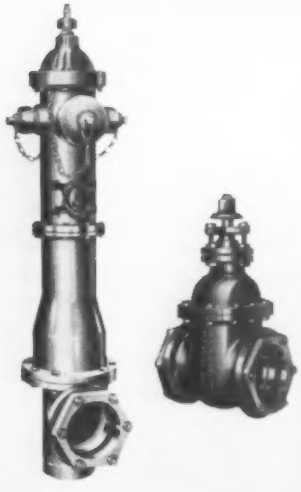


Giant 60" Eddy Valves for Buffalo, New York



As part of a major waterworks improvement program, three 60" and fourteen 48" 300 lb. test IBBM EDDY valves have been installed by Fago Bros., Contractors, for Buffalo, New York. Each 60" valve weighs 44,000 pounds; each 48", 21,500 lbs. These are BIG valves...and do a BIG job.

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WATERFORD NEW YORK

News—Here & There

Vic Ehlers Dies

One of the earliest and most influential devotees of public health and sanitary engineering in the West, Vic Ehlers, State Sanitary Engineer of Texas, died in Austin, Texas, March 20th.

A graduate of Texas A. & M. College in 1905 and Cornell University (C.E.) in 1910, he launched his career in Texas as a consulting engineer. In 1915, due to his continued activity in the stream pollution field, the office of Sanitary Inspector for the State of Texas Health Department was created and he was asked to serve in the position temporarily. As time went on the job became bigger and the title was changed to Chief Sanitary Engineer and eventually to Director of Sanitary Engineering.

Mr. Ehlers was influential in the formation of a Department of Sanitary Engineering by Texas A. & M. College, and sponsored the organization of a Texas Water and Sewage Works Association, a Texas Beach and Pool Association, and a Texas Water and Sanitation Research Foundation. He was the senior co-author of "Municipal and Rural Sanitation", originally printed in 1927 and last revised in 1958 as a fifth edition.

Among the many honors for his contributions to public health and sanitary engineering, he was given the Fuertes Award by Cornell in 1926, Fuller Award by the AWWA in 1941 and Honorary Membership in 1958, the Arthur S. Bedell Award by the F.S.I.W.A. in 1949 and Honorary Membership in 1957. Offices held in national organizations include President of the International Association of Milk and Food Sanitarians, President of the F.S.I.W.A., and Vice President of the A.P.W.A.

Decontamination of Radioactive Waters

The effectiveness of water treatment processes in the removal of radioactive waste materials is the subjects of "Report of the Joint Program of Studies on the Decontamination of Radioactive Waters", a document jointly prepared by the Health Physics Div. of the Oak Ridge National Laboratory and the Robert A. Taft Sanitary Engineering Center of the U.S. Public Health Service, has just been issued by the Public Health Service.

Joint research studies carried on since 1950 by these groups indicate that the degree of removal of radioactive contaminants depends primarily on the chemical form of the contaminant and the particular water treatment process employed. Radioactive materials that might result as waste from AEC and non-AEC installations, as well as nuclear bomb debris were used in the experiments.

It was found that under emergency conditions some removal of radioactive materials would be accomplished by conventional water treatment processes. However, the degree of removal might or might not be adequate, depending on the nature and concentration of the contaminants.

Copies of the complete report and results of analyses are available from the Office of Technical Services, U.S. Department of Commerce, Washington 25, D. C. at $1.00 per copy. Publication number is ORNL-2557.

Waste Bio-Oxidation Course

The Civil Engineering Department of Manhattan College will offer its fourth one-week course on the Theory and Design on Bio-Oxidation of Organic Wastes during the week of June-15-19.

The objective of the course is to present the fundamentals of bio-oxidation which will serve as a framework for the analysis, design and operation of biological waste treatment facilities. Emphasis will be placed on applications of these principles to several wastes from industries including pulp and paper, pharmaceutical, canning and chemical. The fee for the course is $100.

For further information regarding the course, address inquiries to: W. Wesley Eckenfelder, Jr., Civil Engineering Department, Manhattan College, New York 71, N. Y.

N.Y.S.I.W.A. 1959 Officers

The New York Sewage and Industrial Wastes Association, at its recent meeting elected the following officers for 1959: S. W. Steffensen, President; C. J. Bernhardt, Vice-President; R. C. Sweeney, Executive Secretary; D. B. Stevens, Treasurer; and J. C. Brigham, Consulting Treasurer. Francis J. Cramer was the outgoing President.

N.E.S.I.W.A.

The New England Sewage and Industrial Wastes Association, at its fall meeting held at the Statler Hotel, Hartford, Conn., elected the following officers for 1959: Henry F. Munroe, President; Walter M. Kunsch, 1st Vice-President; Joseph B. Hanlon, 2nd Vice-President; Earl R. Howard, Secretary-Treasurer; and Richard F. Greelie, Assistant Secretary-Treasurer. The immediate Past President is John D. McDonald.

Rhode Island Contemplates Statewide Water Supply

Water supply on a statewide basis with the Providence system as its core was recommended in a report submitted to the Rhode Island State Fiscal Study Commission by consultants from the Institute of Public Administration of New York. Another recommendation was that the state take over the Blackstone Valley Sewer District.

To administer the two agencies, which would become divisions of a new State Department of Public Utilities, the consultants proposed that the Providence Water Supply Board and the Blackstone Valley Sewer District Commission become state management bodies.

It was proposed that the state lease the Providence water resources, including the Scituate Reservoir. The distribution system would then be expanded without restriction.

A proposed new Division of Water Supply would be empowered to buy or accept as a gift other local water systems, develop and improve new and existing systems, buy potential reservoir sites and have general su-

Continued on page 9A

Surer sealing... easier maintenance with DARLING-PELTON BUTTERFLY VALVES

DARLING VALVES

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford, Ont.

DARLING-PELTON butterfly valves are new in both principle and performance. They offer you new advantages!

For example, a continuous and adjustable rubber seating ring provides full 360° sealing. The disc itself swings on an axis eccentric to the centerline of the valve.

This principle not only makes surer, drop-tight shutoff possible, but also eliminates shaft sealing problems, permits easy rubber seat replacement or adjustment without removing shaft or operator, and requires less operating torque.

Get all the facts on this forward step in butterfly valve performance. Made to A.W.W.A. Specifications. Ask for Bulletin SLS-5708.

DARLING VALVE & MANUFACTURING CO.
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News—Here & There

CONTINUED FROM PAGE 7A

pervision, including fiscal, over all public water systems.

The recommendations by the consultants called for the state to acquire the Providence system through a long-term lease for which it would pay the city annual rent. The report did not say how much but called for a fair return on the city's equity.

What it termed the wide variety and haphazard buildup of water supply systems throughout Rhode Island was deplored by the report, which noted there are 63 separate public systems.

The report said the urgency of the need for long-range development is matched by the problems of sanitation. It proposed states control of sewage collection, sewage treatment and water pollution.

Colorado to Select Resources Director

The Colorado legislature passed a bill authorizing the governor to hire a director of natural resources outside civil service.

The new director, not yet selected at this writing, will supervise and coordinate all state agencies concerned with natural resources, including water, agriculture, game and fish, mining, oil and gas, parks and recreation.

Modernization of Water Use Laws Recommended

Modernization of Michigan's water use laws was urged by three University of Michigan legislative analysts.

In listing shortcomings of the state's water laws in a chapter of "Water Resources and the Law," published by the university's legislative research center, they cited:

Shifting interpretations of what constitutes reasonable use of existing supplies; artificial legal barriers limiting water use to those owning property adjacent to or over water supplies; failure of the courts to further unified direction in water law or engage in any comprehensive planning for the future.

Also, no answer to the legal question of whether municipalities can use water supplies over the protest of private owners, and no answer to the question of who can add polluting matter to streams, rivers, and underground water supplies.

The analysts recommended establishment of a state agency to control all new water use except that by private households.

Water Use Bills Introduced

The Wisconsin legislature has under consideration four water use regulatory bills prepared to carry out recommendations made by the State Legislative Council after extensive study and public hearings during the past 18 months.

One of the council-backed bills would declare that the development of Wisconsin iron ore resources was in the public service and would empower the State Public Service Commission to authorize water diversion for that purpose. This would give taconite mining companies a means of acquiring adequate water, and at the same time protect public and private water rights.

Prior to issuing a permit for water diversion or use for processing iron ore, the PSC would be required to weigh the public rights in the stream which may be adversely affected—against public benefits in the form of increased opportunities for employment and industrial development and increased income to local agencies of government and the state treasury. If public benefits from a proposed operation outweighed public rights to the stream, which would be impaired or eliminated, the PSC would have to issue the permit.

Other points in the bills included restriction of lake or stream water to use on riparian land or adjacent land that was in an original government riparian grant, and require the PSC to take into account fish and wildlife values when issuing diversion permits.

Furthermore, a PSC permit would be required to straighten or change the course of a navigable stream.

The PSC would have the authority to impose new heavy penalties of $1,000 fine, six months in prison, or both, for unlawful obstruction or diversion of water from navigable lakes and streams without a permit.

First Municipal Desalting Plant

February marked the opening of the nation's first municipal water desalting plant at Coalinga, Calif.

Located on the arid west side of the San Joaquin Valley, Coalinga's 6500 citizens are abundantly supplied with hard, highly mineralized well water containing about 1/15th the mineral strength of open sea water. This water is used for irrigation and some household purposes—but not for drinking and cooking. For the past 50 years, the City has obtained drinking water by railroad tank car shipments from Armona, Calif., about 45 miles away. Now the City's new "electric membrane" desalting plant will remove over 400 pounds daily of salt and minerals from 28,000 gallons of well water supplying the City's separate drinking water distribution system.

The City will realize a substantial saving in operation of the plant since the freight charges on their tank car water came to about $7.05 per 100 gallons—and last year totaled about $52,000. The new plant is expected to save the City upwards of $400,000 in the next 10 years and to pay for itself in less than three years.

Mississippi River

pollution control has taken a major step forward by the Metropolitan St. Louis Sewer District when its Board of Trustees approved a $240,000 contract for a 30-month study of pollution and recommendations for its abatement.

The study, to be financed as part of a 285,000 loan already approved by the Housing and Home Finance Agency, will be made by Horner and Shifrin, St. Louis; in conjunction with Havens and Emerson, New York. The remaining $45,000 will be used by MSD to finance tests and to provide certain technical data needed for the study.

The study will indicate exact sources of pollution and will recommend the number and type of sewage treatment plants to be built, as well as methods of financing.

Continued on page 11A

ANNOUNCING...

BROADENED LICENSING OF THE CRP* ACCELERATED SLUDGE DIGESTION SYSTEM

Accelerated
CRP*
Sludge Digestion
System
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Available Through Specification of Consulting Engineers . . . for Use With Gas Recirculation Equipment Supplied and Engineered By Approved and Experienced Manufacturers of Sludge Digestion Equipment.

INFORMATION IS AVAILABLE to Consulting Engineers from Chicago Pump Company or its Distributors . . . pertaining to the application of this system and license fees for its use in existing or new digesters designed for present or future maximum digester loadings.

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43

operating and specified installations of CRP* since 1953 prove its unparalleled acceptance . . . and these advantages:

Savings

1. A 2/3 reduction in new tank volume requirements.
2. Simplified plant operation due to sludge homogeneity.

Performance

1. Produces required biological reduction of solids in 1/3 to 1/7 tank capacity.
2. Normal quantity of gas produced at higher rates.
3. Complete absence of digester scum.

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1959 50 YEARS CHICAGO PUMP COMPANY 1909

News—Here & There

CONTINUED FROM PAGE 9A

Syracuse Offers MS San Eng.

The Department of Civil Engineering of Syracuse University, N. Y., is offering a new curriculum available to persons holding B.S. degrees in Engineering, Chemistry or Bacteriology leading to the degree of Master of Science in Sanitary Engineering.

Research Assistantships, available in this program commencing June 1, 1959 has a remuneration of $3,000 per year, plus remission of tuition and fees.

Address inquiries to Chairman, Civil Engineering Department, Syracuse University, Syracuse 10, N. Y.

Radioactive Decontamination of Water

The Bayerische Biologische Versuchsanstalt, Munich, Germany, has announced an advanced course for 1959 on "Possibilities and limits in removing poison and radioactive substances from sewage and industrial waste waters".

The course will be held on October 5-10, under the direction of Professors Dr. R. Demoll and H. Liebmann.

Registration fees for the course is DM 60,-, including travel expenses for the excursion. Reservations should be made by September 15 to Professor Dr. H. Liebmann, Bayer. Biologische Versuchsanstalt, Munich 22, Veterinarstr. 13.

Vermont

A bill to authorize a $1 million state bond issue for continuance of a program of state aid to municipalities for the construction of sewage treatment plants was passed by the Vermont House and sent to the State Senate.

Under the program, municipalities building approved sewage treatment facilities can qualify for 20 percent state aid. They also are eligible for about 30 percent federal aid toward the cost of pollution abatement projects.

Texas

Plans to build two reservoirs capable of a combined yield of 160 million gallons of water daily on the West Fork of a river near Conroe were submitted to the Texas State Board of Water Engineers by the San Jacinto River Authority.

Research Assistantships

Research Assistantships in Sanitary Engineering are available at the State College of Washington for the academic year 1959-60. Students can complete the work for the Master of Science in Sanitary Engineering degree in three or more semesters.

Applicants should normally have an engineering degree and essential prerequisites for their specific graduate program, or be willing to make up deficiencies. Full-time work is generally available during the summer. A minimum of two semesters is required of full-time students.

For further information, write E. B. Moore, Chairman, Department of Civil Engineering, State College of Washington, Pullman, Washington.

San. Engr. Courses

at the graduate level will be offered this summer by the Public Health Service Sanitary Engineering Center at the Western Massachusetts Public Health Center on the campus of the University of Massachusetts during the period July 20 thru August 14, 1959.

The content of the courses to be presented will be the same as those presented at the Sanitary Engineering Center in Cincinnati. Special equipment and training staff will be brought from Cincinnati, to assist the University and Health departments. The following four courses will be offered:

July 20-31—Basic Radiological Health
July 27-Aug 7—Water Pollution Biology for Engineers
Aug 3-14—Atmospheric and Source Sampling
Aug 10-14—Bio-Assay of Pollution Ecology.

Applications and further information on the Public Health Service Sanitary Engineering Center Summer Training Institute may be obtained from: Sylvan C. Martin, Sanitary Engineer Director, Regional Engineer, Region II, Public Health Service, 42 Broadway, New York 4, N. Y.

Water Department Catering Service

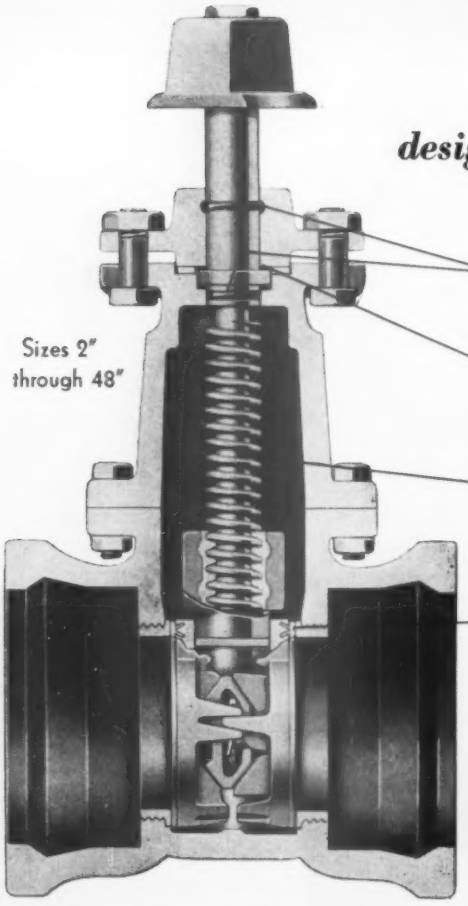
On the Monon RR's Thoroughbred heading toward the Indiana Section AWWA meeting a "slight" foul up in operation left all the passengers without lunch or the means to get it. At this point Joe Taub, Asst. Foreman of the East Chicago, Ind. Water Department stood up to announce that being farsighted as all waterworks men are his boss Mr. Peter Vintila, Superintendent at East Chicago had provided for lunch and he was taking orders for sandwiches, coke and other appropriate refreshments. The East Chicago boys then proceeded to serve an excellent lunch.

Saline Water Conversion Plant

Secretary of the Interior Fred A. Seaton has announced that a multiple-effect distillation process has been selected for the first saline water conversion demonstration plant, under the Department's Office of Saline Water conversion project. The plant will convert sea water to fresh at the rate of 1,000,000 gpd.

This development is an outgrowth of the long-tube vertical (LTV) process started early in 1955. The Office of Saline Water contracted with the consultant engineering firm of W. L. Badger & Associates, Ann Arbor, Mich., to conduct a detailed study of the potential economic advantages of multimillion gpd distillation cycles. The results of that study proved very promising, if the critical assumption that scaling and corrosion could be prevented at little cost to the process. From this experimental facility at Harbor Island, N. C., which utilizes one seven-tube LTV evaporator or simulating the variations of a large multi-effect distillation cycle was established.

The Office of Saline Water stated that a site for this first demonstration plant has not yet been selected, but over 80 cities have expressed interest in having a plant located in their areas. All interested cities have been asked to submit specific information in response to a questionnaire, "General Guides for Saline Water & Conversion Plant Location Consideration," which is available from the Office of Saline Water.



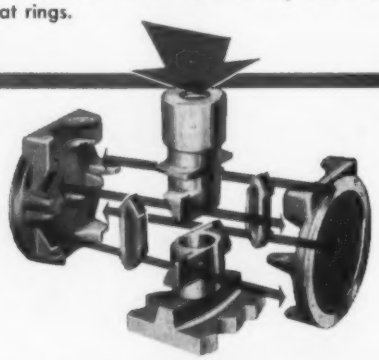
designed for minimum maintenance!

"O" Ring Stem Seals . . . "O" ring at bottom provides a positive water-tight seal. Upper "O" ring seals dirt and water from bearing surfaces and acts as a reserve pressure seal.

Lubricant Reservoir . . . the area between the "O" rings is filled with a special, lifetime lubricant. Each time the valve is operated, both "O" rings and thrust collar are completely lubricated.

Heavy Bronze Stems . . . are machined from high tensile strength solid bronze rod for all valves up to 16". Electrically upset thrust collar improves grain structure. Valves 18" and larger have stems cast from extremely high tensile strength manganese bronze.

Bronze Disc Rings . . . are dovetailed to become part of the disc and are then machined for precise mating with the seat rings.



MUELLER® gate valves

You can forget about the gate valves in your water supply and fire protection systems when they're Mueller Iron Body, Bronze Mounted Gate Valves. All of these valves are Double Disc, Parallel Seat type specifically designed for water distribution piping. Long-life features, dependability features, and ease of operation features assure you of years of maintenance-free service. These features are typical of the great attention to detail in research, design and engineering that becomes a part of every Mueller product made for the water industry. Write for complete information.

Four Point Wedging Mechansim . . . exerts even pressure at four points near the outer edge of each disc to eliminate disc deflection and distortion and to assure tight shut-offs.

Exclusive Disc Movement . . . discs move in an inverted "T" manner, as shown, when valve is opened or closed. The entire disc and wedging mechanism is held together as a unit by special bronze pins passing through interlocking lugs that are cast integrally with each disc. This permits operation of valve in any position. These pins and lugs also control the amount of disc movement. By maintaining a minimum of clearance, discs positively shear incrustations and deposits from seat ring upon closing.

Opposed Wedges . . . on top nut eliminate binding or twisting of stem. Nut is free to rotate and the only forces on the stem are straight up or straight down.

MUELLER CO. **DECATUR, ILL.**

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

Equipment News

Dissolved Oxygen Meter for Surface Water

501

The Hays Corporation, Michigan City, Indiana, has developed a new dissolved oxygen meter for analysis of effluents from sewage and industrial plants.

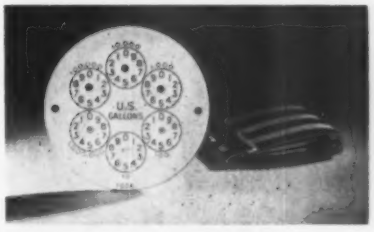
The operation of the analyzer is based on a common gas law known as Henry's Law. The inlet nozzle, is immersed in the source to be analyzed, and sample water is pumped through the pressure regulator into the aspirator, where it is thoroughly mixed with nitrogen gas confined in the system. The water and gas mixture is then forced into a separator where the gas is separated from the water. The water passes through the separator and leaves through a flow restrictor. The gas which has been separated from the water then flows through the flood control and air check valve into the magnetic oxygen analyzer.

The magnetic oxygen analyzer is connected to a recorder which indicates and records the dissolved oxygen content of the water in percent of saturation.

Plastic Meter Dial Plate

502

Hays Mfg. Co., Erie, Pa., has developed a water meter dial plate, molded of glass fiber reinforced



Plaskon Polyester 941, that resists rust and corrosion and eliminates replacement problems.

The easy-to-read plastic dial features printing laminated into its surface. This eliminates the field replacement problem encountered with conventional metal dial plates, which chip and corrode.

Characteristic of the Plaskon Polyester Resin used is the ease with which it may be formed and its excellent resistance to heat and common solvents. Made in sheets and cold-punched, the Haysite dial plate also claims a definite price advantage over conventional materials. It is distributed through Hays' General Products Division.

Improved Waterstop

503

W. R. Meadows, Inc., Elgin, Ill., has introduced a modern, improved Waterstop to be sold under the trade name of Sealtight "Hydrojoint" PVC Waterstops.

"Hydrojoint" Waterstops are extruded from a special compound of Polyvinyl-chloride to which has been added important plasticizers and stabilizers to provide all of the qualifications necessary for the effective performance of a waterstop. The waterstops are engineered with a cross-section featuring improved-design multi-ribs to provide a tenacious holding power . . . the center

Continued on page 15A

to reduce installation costs and corrosion problems . . . provide maintenance-free service, specify—

WASHINGTON ALUMINUM EQUIPMENT FOR WATER AND SEWAGE PLANTS

1-PC. ALUMINUM GUIDES AND STOP PLATES OR SLUICE GATES

Our one piece unit means faster, more economical installation. No more riveted flat bar assemblies or machined grooves. Non-corrosive.

SAFE, NON-SKID ALUMINUM WALKWAYS

Special upset pattern provides non-skid safety. Never needs painting; resists rust and corrosion. I-Beam design gives "strength of steel" with far less weight.

For Free Product Literature, Write

WASHINGTON ALUMINUM CO., INC.

Dept. 75 BALTIMORE 29, MARYLAND

PANACEA FOR SALE

. . . just Pennies a day!

AQUA NUCHAR

ACTIVATED CARBON FOR TASTE AND ODOR CONTROL

Few products can truly be called cure-alls. But if you have a taste-odor problem at your plant, whatever the cause, we sincerely believe AQUA NUCHAR is the cure!

It's a proven fact. Properly applied in adequate dosage, AQUA NUCHAR activated carbon effectively adsorbs all taste- and odor-forming substances recorded to date in water supplies.

Extremely low average concentrations spread hundreds of billions of porous particles in fine dispersion throughout the water being treated. The high surface activity of these particles quickly traps odors and removes them in sedimentation. Treated water remains sweet and sparkling.

Our research staff is available without obligation to discuss your taste and odor problems with you. We will gladly recommend economical, dependable controls using AQUA NUCHAR. Call, wire or write today.

industrial CHEMICAL SALES
division west virginia pulp and paper company

230 Park Ave., New York 17 · Philadelphia National Bank Bldg., Philadelphia 7 · 35 E. Wacker Dr., Chicago 1 · 2775 S. Moreland Blvd., Cleveland 20

Equipment News

Continued from page 13A

bulb has been designed to provide the ability to successfully handle tremendous pressures caused by concrete movements.

Specifications of the waterstop are reported to be as follows . . . tensile strength . . . 2250 psi; ultimate elongation . . . 300%; temperature range . . . from +176°F to −50°F; cold brittleness test . . . −50°F; chemically resistant to chlorinated water, salt water, acid, alkalis, sewage wastes, oils, etc.

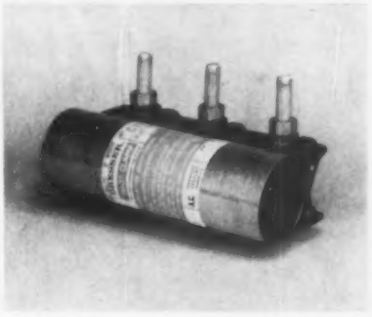
"Hydrojoint" PVC Waterstops are strong, lightweight and easy to handle. . . supplied in 50 feet coils . . . individually packaged.

Repair Clamps

504

Dresser Mfg. Div., Dresser Industries, Bradford, Pa., has announced that efficient, fast, economical repair of full breaks or holes in small-diameter asbestos-cement and cast iron water and sewage lines is now possible with Dresser's new 2 and 3 in. "360" all-around Repairs Clamps. These new clamps differ in design from the larger size "360" in that they have lugs on only one side.

This feature simplifies installation of these smaller size clamps. Just remove the bolts from the lugs, spring the clamp around the pipe, re-insert the bolts and tighten the nuts.



Dresser's exclusive "360" sliding lug design is maintained in these smaller sizes. This unique design eliminates all weak or loose parts, assures a positive, leakproof seal. Bolt pull is transmitted effectively into pressure preventing pivoting action or bolt bending. The lugs also permit a range of adjustability sufficient to compensate for variations in asbestos-cement and cast iron pipe diameters. The lugs are made of Grade A malleable iron, coated with Dresser "Red-D" shopcoat, for maximum strength and corrosion resistance.

Cement Lining of Small Pipe

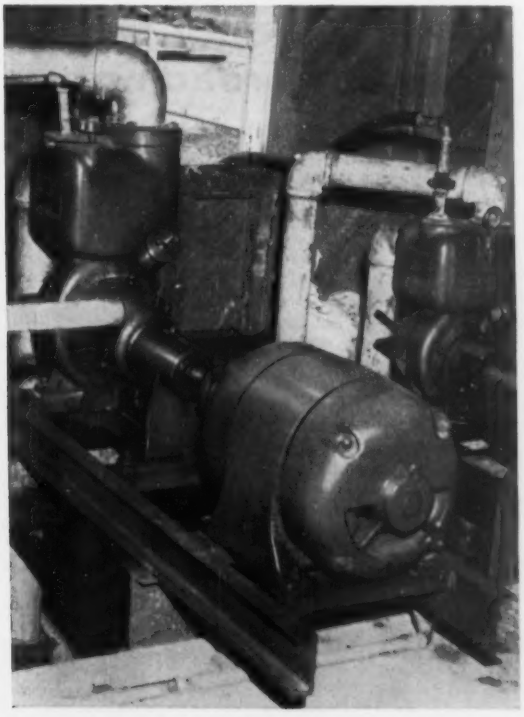
505

Centriline Corp., New York, N. Y., has developed a new machine for lining small diameter pipe. The device applies mortar centrifugally to pipes as small as 4 in. diameter. This method now replaces the old lining process of dragging a mandrel through a mortar-filled pipe.

In operation, spring steel rods are pushed through the pipe carrying a steel cable to the opposite end. The line is then scraped to remove tubercles. Next, the machine's mortar hose is passed through the pipe, along with a power cable and a pulling cable. All three are attached to the lining unit at the opposite end. The machine is

Continued on page 19A

GORMAN-RUPP SEWAGE PUMP

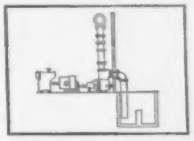


costs less to buy . . . less to operate, maintain

Have you discovered the tremendous advantages of this self-priming centrifugal pump by Gorman-Rupp?

In installation after installation, in lift stations and treatment plants, this amazing unit has shown an outstanding record of success. In a typical instance, less than *half* the cost of alternate equipment. And the maintenance has been almost nil.

Here are the facts: self-priming in lifts up to 15 feet, positive in action, nearly completely non-clogging. Removable end plate provides fast access to impeller and wear plate with just a turn of the wrist. No longer need pump servicing be done in the pit or by raising whole unit by crane. Unit is high and dry. The non-clogging impeller passes spherical solid as follows: 3″ pump, 1½″ solids; 4″ pump, 2″ solids; 6″ pump, 2½″ solids.



Write today for details. You'll be delighted at the low price and record of performance.

THE GORMAN-RUPP COMPANY

305 Bowman Street **Mansfield, Ohio**

Build a real future for your water department with the new

Read-o-Matic*

a REVOLUTIONARY product.... for a totally new method of reading

Now your water department can look to a future of increased efficiency and economy — through the Badger Read-o-Matic, industry's first *practical* outdoor register.

With this revolutionary new outdoor register, you'll play a major role in community progress . . . by providing consistently better water department operation and service to *every* customer . . . starting with these *immediate* benefits:

BOOSTS WATER DEPARTMENT NET REVENUE

Eliminated: meterman recalls, "read-it-yourself" cards, estimated water bills. Result: reduced reading costs . . . and greater savings because of simplified department accounting and operation.

100% METER READING IN HALF THE TIME — AND NO WASTED CALLS

The Badger Read-o-Matic overcomes the chief problem of indoor reading: depending on the customer to be home. Instead, a meterman can complete his reading route in half the time it used to take by the old method — because the register is **outdoors** and always available.

BETTER SERVICE AND CUSTOMER GOOD WILL

Because the Badger Read-o-Matic is accessible to the meterman at all times, the customer will never be inconvenienced again. Your meter records are always up to date; the customer's meter bills will always be accurate.

*Patents applied for in U. S. A. and foreign countries.

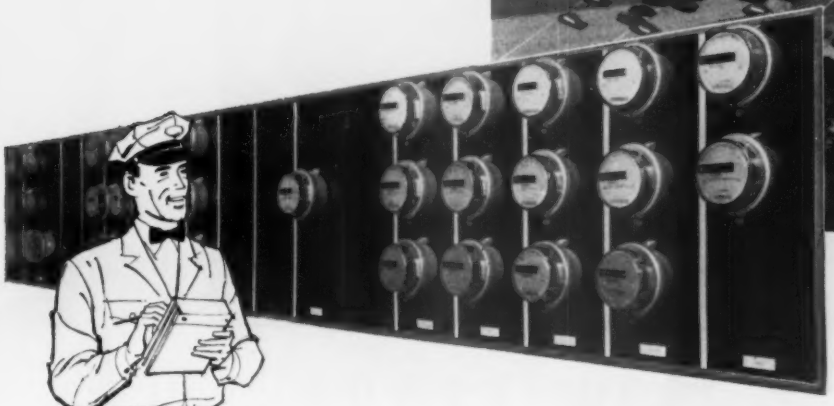
Dynamic New Idea!

Central reading stations

Glamorous *Mayfair,* Milwaukee, marks a new trend in ultra-modern suburban shopping centers. Its *metering system* — trend-setting,too.

A network of Badger Read-o-Matic registers serves Mayfair's more than 85 stores. Meters are located in the stores... connected to a central Read-o-Matic reading station for each section as shown in color on the aerial view (right). A typical panel of Read-o-Matic registers at Mayfair is shown below.

Meter reading — just a few minutes' work. And the Read-o-Matic registers are always accessible.



...Another in Badger Meter's big parade of new products for better water metering

Key to the Badger Read-o-Matic register — a self-powered generator that requires no outside source of power. It originates its own pulses that are recorded on the outdoor register. The register can be placed as far as one-half mile from the meter itself.

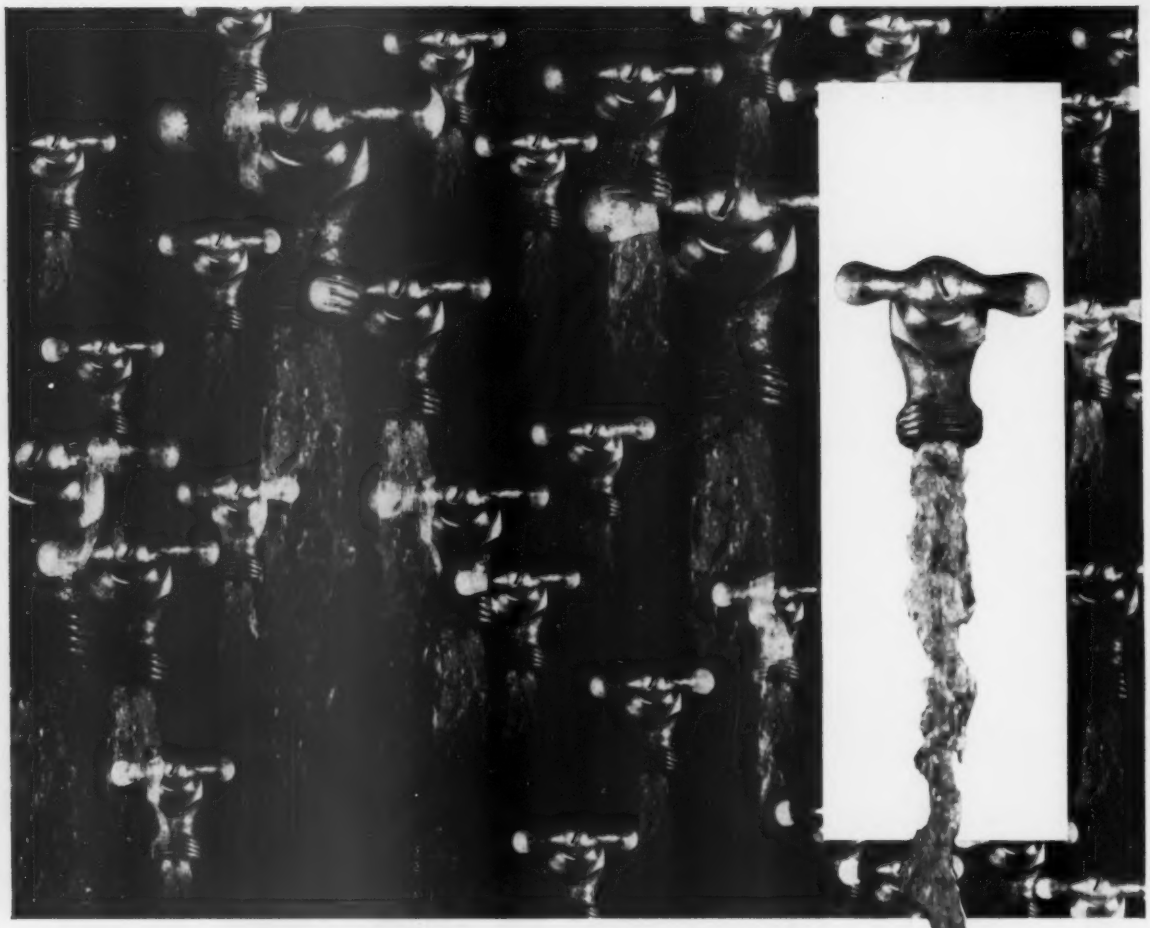
This revolutionary meter-register is another product of Badger's research devoted *exclusively* to the continuous improvement of water meter design, construction and performance.

Write us today. We'll send a free, colorful brochure with full details about the new Badger Read-o-Matic outdoor register.

Badger Water Meters

Badger Meter Mfg. Co. • 4545 W. Brown Deer Rd. • Milwaukee 18, Wis.

OFFICES IN PRINCIPAL CITIES



450-1 flow range
TOTALIZED ON ONE REGISTER

SPARLING BROAD GAUGE COMPOUND METERS

No conversion; no duplication; no wasted water... Sparling Broad Gauge Compound Meters provide the broadest range of accurate metering available, with all flows *registered on one totalizer.*

LOW FLOWS, down to 2.5 gpm, are registered with the positive accuracy of a displacement meter...**HIGH FLOWS** utilize the exclusive Sparling propeller meter design for maximum accuracy and minimum head loss. Flows metered up to 2250 gpm are standard...**TOTAL FLOWS** up to a 450 to 1 range are registered on one common 6 digit straight-reading totalizing register within 2% accuracy. Available in sizes 6"x 1½", 8"x 2", 10"x 2", 12"x 2".

Write for Technical Bulletin No. CF 333-1

SPARLING
WATER CONTROL EQUIPMENT

SPARLING METER COMPANY *225 N. Temple City Blvd., El Monte, California*

Atlanta 3 • Chicago 4 • Cleveland 13 • Dallas 1, Tex. • Denver 6 • Kansas City 6, Mo. • Roselle, N. J. • San Francisco 2 • Seattle 99 • Romford, England

Equipment News

CONTINUED FROM PAGE 15A

then pulled through the pipe. Metering the mortar pump and regulating the rate of travel controlled the thickness. To apply a ⅛ in. coating, the machine travels some 15 fpm and its dispensing head rotates at about 1,000 rpm.

American Ductile Iron Pipe

506

American Cast Iron Pipe Co., Birmingham, Ala., has introduced a complete line of pipe, tubing, casing, fittings and special castings made from American ductile iron.

A major application for this ductile iron line is for water service mains where high pressures, extreme beam and crushing loads, unusual shocks and stresses, unstable bedding and deep fills may be encountered, and under such adverse conditions the new pipe will actually twist and bend without breaking.

The new ductile iron pipe offers extra strength and bendability to withstand the most rigid service conditions, including rough and careless handling, and, in addition, its

tested and proven corrosion resistance assures maximum service life without the added expense and inconvenience of special coatings and wrappings. The new pipe provides ample wall thickness suitable for direct taps into the pipe wall without saddles or welding.

Reodorants

507

Rhodia, Inc., New York, N. Y., has announced that in order to complete their specialized line of Industrial Reodorants for treatment of Municipal Sewage, particularly in sewage lagoon areas, they have developed a low cost neutral fresh type spray product.

The new product, known as Almask REQ, RLT, 452, can be readily applied with any standard type spray equipment. This material is water dispersible, contains a highly active ingredient, and requires no special handling.

Controls For Plant Odors

508

Associated Specialties Co., Detroit, Mich., has developed "Stop", a new organic chemical liquid that eliminates objectionable industrial odors by attacking the bacteria that cause them. An emulsifiable orthodichlorobenzol, it is easily diluted with five parts of water for application by hand spray gun, tank-type sprayer,

Continued on page 21A

ACCURATE GRAPHIC AND VISUAL REGISTRATION

of liquid flow with

STEVENS

RECORDER TYPE B-FT

Recording, indicating and totalizing meter for measuring sewage or other flows over Parshall flumes and weirs. This instrument has interchangeable flow cams and flow conversion gears... an important factor to consider for sewage treatment plants in rapidly growing communities. With a simple change of cams and gears the Type B-FT Recorder can operate with a different size flume or accommodate a greater range of flow than that for which it was originally purchased. The change does not require factory service. Similarly, change from weekly to daily time scale, or vice versa, is accomplished by merely repositioning one gear — no new parts to buy.

This recorder can be direct float operated or remotely controlled and is available for wall or switchboard mounting, or with cabinet for mounting out of doors directly over the float well. Request BULLETIN 25 for complete details.

STEVENS HYDROGRAPHIC DATA BOOK

Invaluable for your reference file. Contains technical data on recorder installations, plus a wealth of hydraulic and conversion tables. $1 copy. (No COD's)

LEUPOLD & STEVENS INSTRUMENTS, INC.

4445 N. E. GLISAN STREET · PORTLAND 13, OREGON

Specialists in hydrologic instruments for over half a century.

NO. 2 OF A SERIES

THE FACTS ABOUT FRESH SOLIDS DEWATERING

FRESH SOLIDS DEWATERING ON COILFILTERS BACTERIOLOGICALLY CONSISTENT WITH SAFE DISPOSAL

COMPARISON OF COLIFORM REDUCTIONS IN SEWAGE SLUDGE

1. Digestion and Drying Beds	99.999+%
2. Digestion and Vacuum Filters	99.999+%
3. Vacuum filtration of Fresh Solids	99.999+%

Survey results at 18 sewage plants support laboratory findings that show dewatered fresh solids bacteriogical quality equal to that of dewatered digested sludge and to digested sludge from drying beds.

Chemical conditioning, high pH and water removal produce massive reductions of coliform population, rendering the final product suitable and safe for ultimate disposal by any of the standard available methods. As for odor, the filter cake is rendered biologically stable, precluding odor production or other nuisance.

The sewage treatment plant incorporating fresh solids dewatering costs less initially than a plant with another dewatering method—and it costs less to operate.

KOMLINE-SANDERSON ENGINEERING CORPORATION

PEAPACK, NEW JERSEY

MANUFACTURER OF COILFILTER SLUDGE VACUUM FILTERS AND AUXILIARY EQUIPMENT FOR DEPENDABLE FRESH SOLIDS DEWATERING

Equipment News

CONTINUED FROM PAGE 19A

large commercial spraying equipment or by drip method.

An easy-to-use, fast-acting liquid, "Stop" has successfully eliminated odor complaints from a wide variety of sources, including sewage, leather and rendering plants, land-fill waste disposal projects, industrial lagoons and food processing plants.

The liquid is equally effective on a smaller scale for controlling odors in incinerators, garbage cans, rubbish heaps, septic tank fields, drainage ditches and many similar places. "Stop" also prevents odor trouble spots from becoming breeding places for rodents and insects.

Plastic Base Jointing Compound

509

K. T. Snyder Co., Houston, Texas, has developed a new Root-Seal Primer that when used with Root-Seal hot pour plastic base joint compound, is said to provide permanently watertight and root-proof joints at low initial costs and substantial reduction in infiltration of ground water, and roots.

Among the features claimed for the new seal are: flash and fire point in excess of 650°F permits even overheated material to be unchanged for pouring joints with less trouble; no irritating or obnoxious fumes while heating and pouring joints in ditch; melts quickly in kettles; sets up faster in joint; and immediate backfilling.

According to the company, the high strength Root-Seal joints have been tested by a leading independent laboratory with 100% resistance to leakage when subjected to internal hydrostatic pressure tests and held at 40 psi for 15 minutes.

Continuous Weigher And Feeder System

510

Stephens-Adamson Mfg. Co., Aurora, Illinois has recently developed a continuous weigher and gravimetric feeder system that is said to provide extreme accuracy in automatic feeding. The weigher consists of a circular trough through which pass a series of flights attached to a rotating plate. These flights convey the material in a positive, continuous flow circularly through approximately 300° from the entrance to the exit points. The pivot axis of the weigher and the entrance and exit points are all in vertical alignment, providing for easy installation within existent processing operations. The control system for the weigher is adaptable to the standard 3 to 15 P.S.I. pneumatic air signal control or mechanical systems.

As an added accessory, a recorder can be included to give a record of the flow. Generally, this will be a 24-hour dial recorder, but a continuous type can be furnished. They can be either electric or springmotor driven and located at a point remote from the weigher.

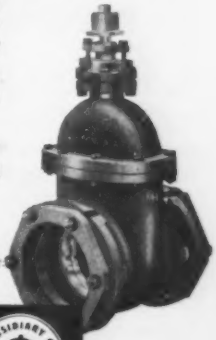
Continued on page 23A

WHAT BECAME OF TYPHOID?

Not until after 1900 (about 55 years ago) did U. S. citizens really accept public water supply systems as sources of potable water. Scientists discovered water borne disease germs in 1875. It then required about 30 years for the people to believe that such serious diseases as dysentery, cholera and typhoid fever epidemics were due to germs in their drinking water. Finally they realized that water could be clear, cold and fresh tasting, yet dangerous to drink. The water works industry therefore built treatment plants . . . sand filters and chemical feeders. The public abandoned private wells. Today, water-borne disease in America has virtually disappeared. In some 50 years, the U. S. typhoid death rate has dropped from 200 to less than 1 per 100,000 persons. Hippocrates, the "Father of Medicine", in 400 B. C., told the Greek people to boil water before drinking it, but today America's public water supplies are safe.

The water works superintendent in a real sense today is a custodian of public health and a vital force in the Nation's economy.

This Series is an attempt to put into words some appreciation of the [illegible] water works men of the United States.



M&H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA
SUBSIDIARY OF WALWORTH

TELETAX* TELEMETERING

engineered for the most advanced transmission techniques

TELETAX RECEIVERS
Teletax Receivers include: Single or Dual Receivers; Multi-Record Receivers for recording up to 6 separate measurements on one chart; and Teletax Receiver-Controllers for automatic operation. And the Teletax signal can be simply converted to digital information.

Telemetering matched in performance with famous Foxboro instruments — that's the Foxboro Teletax Telemetering System.

Through use of impulse-duration signals, Teletax electrically transmits measurements of a remotely-located variable to the central control station. Here, the Teletax receiver records the duration of impulse, which is directly proportional to the measured variable.

The Foxboro Teletax System is noted for its simplicity, its versatility, and its high sustained accuracy. For a transmission medium, it can use either AC or DC, an audio frequency carried on a transmission line, or radio or microwave impulses. Sustained accuracy is 0.5% of full scale.

TRANSMISSION LINK
With Foxboro's Teletax Telemetering System, you can use the most advanced transmitting techniques: two wire lines, power lines, radio or microwave. As many as 25 different signals can be handled in each direction, simultaneously.

TELETAX TRANSMITTER
The Teletax Transmitter houses either one or two standard Foxboro measuring elements — plus the Teletax transmitting mechanism. It will transmit to a control center hundreds of miles away just as easily as to one nearby. It also indicates or records locally if desired.

The Teletax Transmitter needs no periodic maintenance whatever, while the receiver requires only occasional oiling. And the receiver has a minimum of mechanical components to wear — no clutch to slip or jam.

Foxboro Teletax Systems are now in wide use on water works, natural gas systems, oil fields, power plants, steel mills, etc. Write for Bulletin 17-11C — it gives all the details. **The Foxboro Company, 895 Neponset Avenue, Foxboro, Mass.**

*Reg. U. S. Pat. Off.

FOXBORO
REG. U.S. PAT. OFF.
TELETAX TELEMETERING

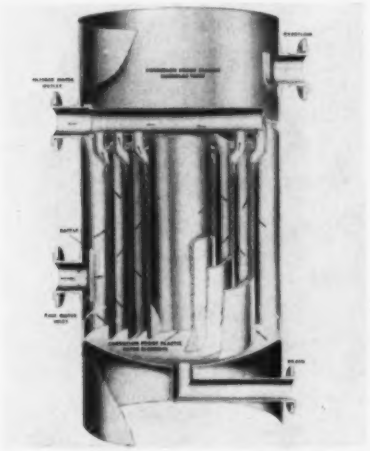
Equipment News

CONTINUED FROM PAGE 21A

Plastic Vacuum Filter For Swimming Pools

511

B-I-F Industries, Inc., Providence, R. I., has introduced a cylindrical, more compact, all plastic swimming pool filter. The new vacuum filter is constructed entirely of corrosion-resistant materials, eliminating special liners and annual paint maintenance.



It is made in seven sizes, from 45 sq ft up to 465 sq ft. It is designed for municipal, institutional and commercial swimming pools, ranging upward from 45,000 gallons.

All external construction is corrosion-resistant fiberglas reinforced plastic, including the filter shell, inner elements and baffles. The concentric elements are made of woven plastic and covered with fine mesh polyethylene sleeves, promoting the smooth build-up of filter aid. The pump draws water through concentric filter elements and the coating of filter aid.

Features of Proportioneers Vacuum filter are low original cost, low operating cost, less horsepower recirculating pump, longer runs between washings. Open tank construction gives complete visibility to operation and lends itself to easy hosing down for washing.

All-Electric Actuator

512

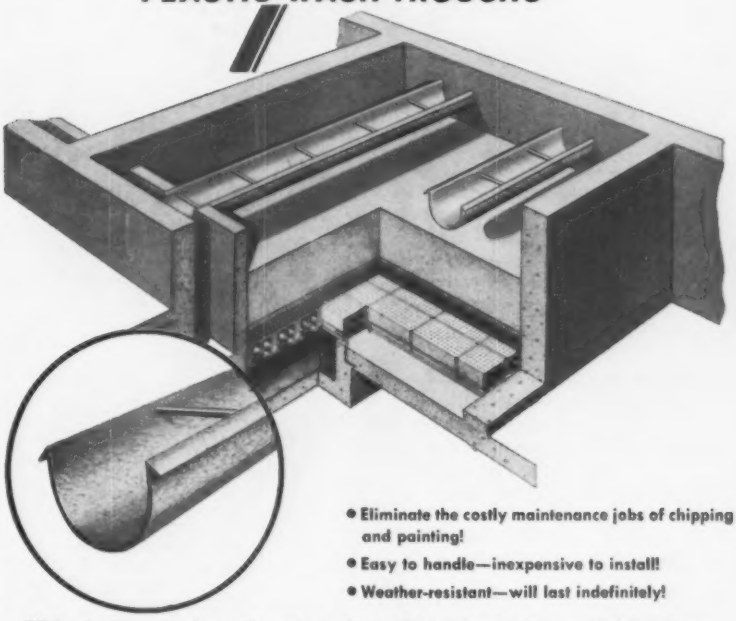
Conoflow Corp., Philadelphia, Pa., has developed a new all-electric actuator that provides economical automatic or remote positioning for throttling control of many types of valves, dampers, louvres, metering pumps, and speed changers. It can also be used for on-off remote pushbutton control with optional position indication.

The Model D-62XW affords precise proportional positioning by means of a slidewire feedback used in conjunction with one of several voltage balance systems now on the market. It is available in a variety of travels from ½ in. to 4 in., with a maximum thrust of 700 lbs. load. A continuously connected handwheel allows for easy manual operation. It is a rugged, compact and lightweight unit, overall assembly of actuator and yoke is only 26 in. high and weighs less than 35 lbs.

Continued on page 27A

Leopold

FIBERGLASS-REINFORCED PLASTIC WASH TROUGHS



• Eliminate the costly maintenance jobs of chipping and painting!

• Easy to handle—inexpensive to install!

• Weather-resistant—will last indefinitely!

With a background of more than 30 years' experience in wash trough design, Leopold has now developed a trough of Fiberglass-Reinforced Polyester-Laminate Plastic—a material that is structurally ideal for wash water troughs.

This new design offers a combination of advantages provided by no other type—uniform strength, dimensional stability, light weight for easy handling, complete resistance to weather and corrosion, built-in sand stop, mold-formed weir edges, and reinforced construction. In addition, Leopold Plastic Troughs, made from extra heavy fiberglass mat, are very durable—will last for years without any painting or other maintenance.

And of particular note—these unique troughs are available in a variety of cross-sectional dimensions, providing capacities to suit individual requirements.

Mail Coupon for Literature —Complete Details

F. B. Leopold Co., Inc.
Zelienople, Pa.

Please send literature on Leopold Fiberglass-Reinforced Plastic Wash Troughs.

Name_____

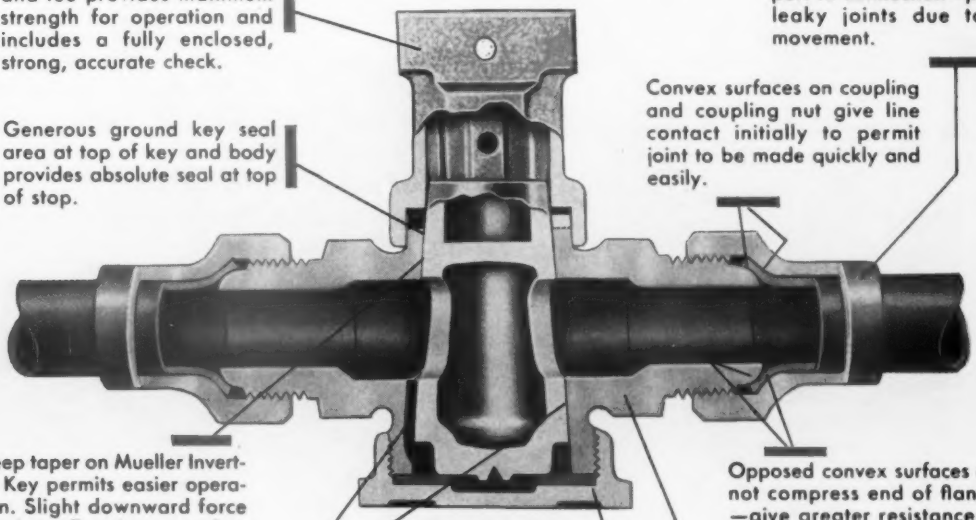
Address_____

City_____ Zone_____ State_____

MUELLER®

inverted key curb stops

easy turning . . . pressure tight . . . maintenance free . . .



Large bronze combined cap and tee provides maximum strength for operation and includes a fully enclosed, strong, accurate check.

Generous ground key seal area at top of key and body provides absolute seal at top of stop.

Steep taper on Mueller Inverted Key permits easier operation. Slight downward force on shut-off rod unseats key for easier turning.

A small bypass allows inlet water pressure to exert force on bottom of key to provide an additional seating force. The higher the pressure, the greater the seating force.

Heavy inverted bronze key is accurately machined and individually ground and lapped into the body for absolute water-tight closures.

Extra long skirt on copper coupling nut gives added support to connection—prevents leaky joints due to pipe movement.

Convex surfaces on coupling and coupling nut give line contact initially to permit joint to be made quickly and easily.

Opposed convex surfaces do not compress end of flange —give greater resistance to pipe pulling out.

Heavy water works bronze stop body gives maximum strength and resists corrosion.

Bronze base cap and resilient leather seal hold key in place. Seal acts as bearing surface when turning key and provides seal at bottom of stop.

H-15200
Inverted Key Curb Stop
Combined Cap and Tee
with Check
Copper Coupling
Connection
Sizes: ½" through 2"

These features are typical of the attention to detail in research, design and engineering that becomes a part of every Mueller product made for the water industry. Mueller Inverted Key Curb Stops are available in a complete range of sizes and styles.

For full details contact your Mueller Representative or write direct to:

MUELLER CO. DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

FILE REFERENCE

FACT SHEET

GRAVER®

Elevated Water Tank Solves Pressure Problem In Ashland, Ohio

Don T. Hostettler, Mayor
Melvin Bauer, City Engineer
Edward F. Petzke, Supt. of Water Works
Uhlmann Associates,
Consulting Engineers
Columbus, Ohio
H. E. Bonham, Project Engineer
Graver Tank & Mfg. Co.
Division—Union Tank Car Company
Design, Fabrication and Erection

Type: Double Ellipsoidal Elevated Tank
Capacity: 200,000 gallons
Height to Overflow: 129′ 11″
Head Range: 29′ 11″
Diameter of Tank: 36′ 0″
Built to AWWA Specifications

THE PROBLEM

The City of Ashland, Ohio, was growing—and it was literally growing uphill. For years Ashland's water needs had been served from a 2,000,000 gallon reservoir on a hillside above the town. Three years ago the city annexed 1,850 acres adjoining the County Fair Grounds, located well above the reservoir. The pumping station could not maintain adequate water pressure for the new residential development.

THE SOLUTION

Uhlmann Associates were selected by city officials as consulting engineers. They made a detailed study, giving special attention to the problem of adequate water pressure in all areas. They recommended construction of a 200,000 gallon elevated water tank on high land near the Fair Grounds as well as a new pumping station at the present reservoir.

Graver was selected to design, fabricate and erect the elevated water tank. Thus supplemented, the new Ashland water distribution system provides ample pressure in all areas and will meet not only the anticipated growth of the city but also the annual peak loads at the time of the County Fair.

Water storage and pressure problems are being solved regularly by villages and cities across the country with Graver's help. Graver's experience of over a hundred years with tank fabrication and erection contributes directly to the solution of these problems, through cooperation with the consulting engineers.

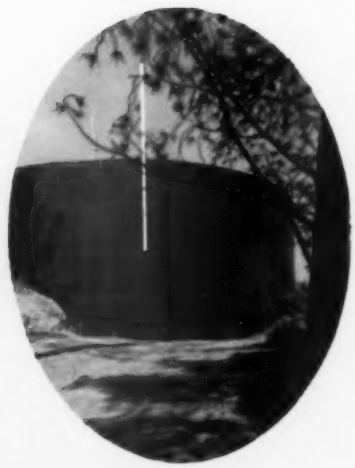
GRAVER TANK & MFG. CO.
DIVISION—UNION TANK CAR COMPANY
EAST CHICAGO, INDIANA

New York • Philadelphia • Edge Moor, Delaware
Pittsburgh • Atlanta • Detroit • Chicago • Tulsa
Sand Springs, Oklahoma • Houston • New Orleans
Los Angeles • Fontana, California • San Francisco
Seattle • Caracas, Venezuela

BUILDING FOR THE FUTURE ON A CENTURY OF CRAFTSMANSHIP IN STEELS AND ALLOYS

GRAVER®

DESIGNED, FABRICATED AND ERECTED BY



WHICH WILL BEST HANDLE YOUR WATER STORAGE?

Standpipe—like that above for Niskayuna, N. Y. or that at the lower right for Norwalk, Conn.? Reservoir—like that at the top right for Beverly Hills, Calif.? Elevated tank—like the one at the right, one of two for Joliet, Ill.? Or a pump suction tank? Graver is long experienced in fabricating and erecting tankage of all types for many purposes. The most suitable tankage for your water storage needs is provided in collaboration with your consulting engineers and water department officials.

GRAVER TANK & MFG. CO.
DIVISION—UNION TANK CAR COMPANY
EAST CHICAGO, IND.

GRAVER®

Plants and Offices Across America

Equipment News

CONTINUED FROM PAGE 23A

Portable Submersible Pump

513

Stenberg Manufacturing Corp., Hoosick Falls, N. Y., has available a submersible, portable electric pump with a maximum capacity of 3,000 gpm at a maximum head of 220 ft. Weighing only 1,200 lbs., it can be moved by truck and light crane, and requires no installation, suction hose or priming.

Other features of the pump are its ability to handle a high proportion of solids without clogging, and to run dry without damage. Pumping starts again as soon as water flows into the sump. In addition, it can run for long periods without supervision.

Newly Designed Safety Treads

514

Wooster Products, Inc., Wooster, Ohio, has developed a new "Traffic-Flow" design for their heavy-duty aluminum safety treads.

The slip-proof "Traffic-Flow" design has a flat abrasive surface that provides a "magnetic-like" feeling when the foot touches each step. A special abrasive formula bonded in a heavy-duty aluminum base gives the Super Stairmaster safety treads a sure grip quality on heavy traffic stairs.

Aluminum treads are distinctive in appearance to meet modern decorative requirements, and pass oil and grease tests more severe than those encountered in most factories and packing plants.

The treads are 9 in. wide with a beveled back and fit all steps up to 13 in. wide. It is provided in lengths to 12 ft. as required. A deep 1⅛ in. nose of heavy aluminum extends over the edge of the step to protect the face. The treads are simply fastened down with screws on wood steps or on masonry stairs with screws and lead expansion shields.

Five Digging Positions Available with New Backhoe

515

Massey-Ferguson Industrial Div., Wichita, Kan., has developed the new Davis 220 Backhoe, with hydraslide positioning to any one of five digging positions.

Other new improvements include increased operating pressure to 2,150 PSI, larger bucket cylinder for 50 percent faster dumping, and a greater breakaway power up to 14,000 lbs.

The new model 220 with the Hydraslide makes it possible for one man to move the entire digging assembly along the frame to any of the five positions in less than five minutes. The operator's seat and controls move right along with the digging assembly, so that the operator is always directly in line with his work.

The Davis backhoe is available for all Massey-Ferguson tractors, including the Work Bull 202 and 303, the Ferguson 35, the Massey-Ferguson 50 and 65, as well as utility models of Ford, International, Allis-Chalmers and Oliver tractors.

Continued on page 102A

ALGAE-FREE WATER
MEANS
Copper Sulfate
treated water
Not only is Triangle Brand Copper Sulfate successful in controlling algae but it also is effective in killing some aquatic weeds. Since the weeds are submerged and disintegrated, there is no chance of them floating down stream to start new infestations, or to clog the waterway.
In sewage systems, Triangle Brand Copper Sulfate prevents roots and fungus from clogging pipes. However, there is no danger of affecting the surface trees owing to the low concentration of copper sulfate necessary to be valuable.
The new booklets "The Use of Copper Sulfate in The Control of Microscopic Organisms" and "Copper Sulfate for Root and Fungus Control in Sanitary Sewers and Storm Drains" will keep you up to date. Send for a copy today! Phelps Dodge Refining Corp., 300 Park Ave., New York 22, N. Y.
PHELPS DODGE REFINING CORP.
NICHOLS
CHEMICALS

Want cobwebs on your complaint phone?

Then use Calgon* — for Calgon stops red water and lime scale — the two main causes of customer complaints. Yes, you can turn complaints into compliments, because whether the "red water" comes from iron present at the source, or iron dissolved from the pipes by corrosion, Calgon treatment is the answer.

When well waters containing iron and manganese are treated with a few parts per million of Calgon, the iron and manganese are kept in solution and the water is as clear at the consumer's tap as it was when pumped from the well.

When red water is caused by iron dissolved from the pipes, it can be prevented with Calgon† treatment because Calgon forms a protective film on metal surfaces. Moreover, this protective film also reduces costly tuberculation damage, flows are kept high and pumping costs are reduced. Calgon treatment is particularly effective after water main cleaning since the protective film forms quickly and tuberculation never gets a chance to start.

A report of a twenty-four month study on the efficiency of Calgon in maintaining pipeline flows is available. Ask for a reprint of this paper.

Write or phone for more information. An experienced Calgon engineer will be glad to make detailed recommendations on your specific problem.

* Calgon is the Registered Trade Mark of the Calgon Company for its glassy phosphate (sodium hexametaphosphate) products.

† Fully licensed for use under U.S. Patents 2,337,856, 2,304,850 and 2,358,222.

CALGON COMPANY

DIVISION OF **HAGAN** CHEMICALS & CONTROLS, INC.,

HAGAN BUILDING, PITTSBURGH 30, PA.

In Canada: Hagan Corporation (Canada) Limited, Toronto

WHICH GRIT COLLECTOR *will protect your system best?*

LINK-BELT builds 7 types, can recommend the most efficient for your needs

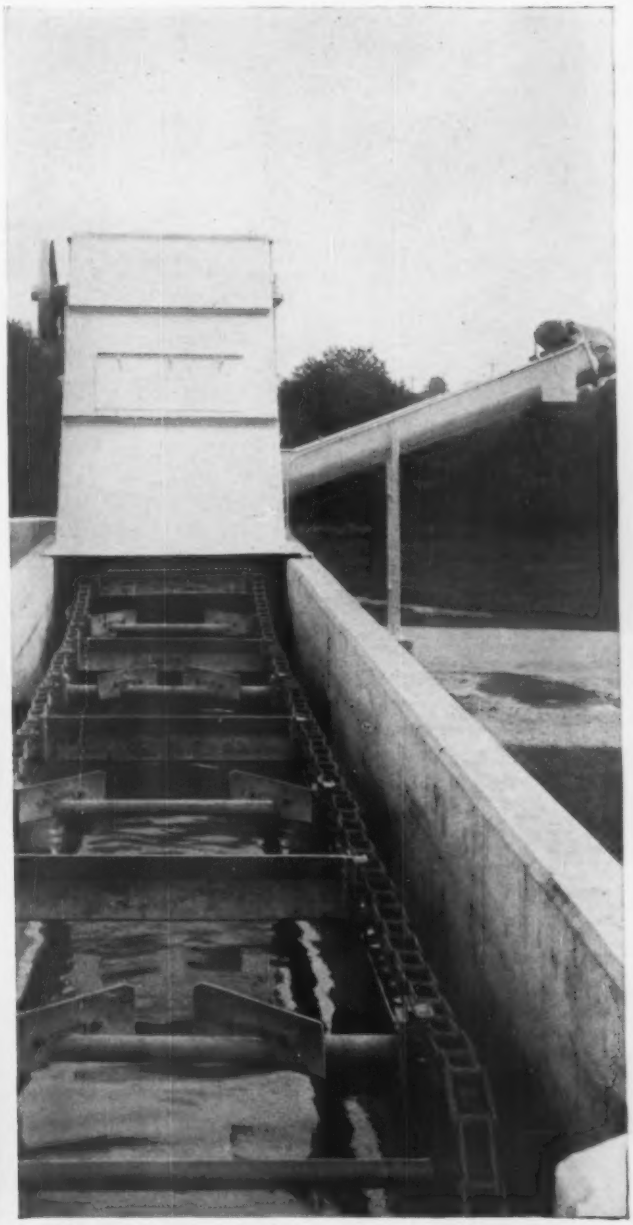
Modern sewage treatment requires grit removal to reduce maintenance costs on mechanical equipment and eliminate operational difficulties. Link-Belt has been manufacturing the finest in grit collection equipment for over 25 years—offers types and designs for any local conditions or requirements. For full details, contact your nearest Link-Belt office. Or write for your copy of Grit Collecting and Grit Washing Book 2571.

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

TYPE AB AERATED GRIT COLLECTORS are ideal for large installations, or at plants where it is desirable to combine pre-aeration and grit removal in the same tank. They consist of a Type B grit collector and porous tubes for admitting compressed air.

TYPE SW GRIT WASHER is a separate screw that washes and dewaters grit conveyed to it by pump, ejector, air lift or mechanical means. It can be counted on for long, dependable service in separating grit, water and putrescible matter.



STRAIGHTLINE GRIT COLLECTORS provide an easy method of collecting settled grit and inert solids without draining the grit chamber. These solids are dewatered and removed from the chamber by flight conveyors, screw conveyors, or buckets attached directly to the collectors. Shown is a Link-Belt Type B double-strand installation.

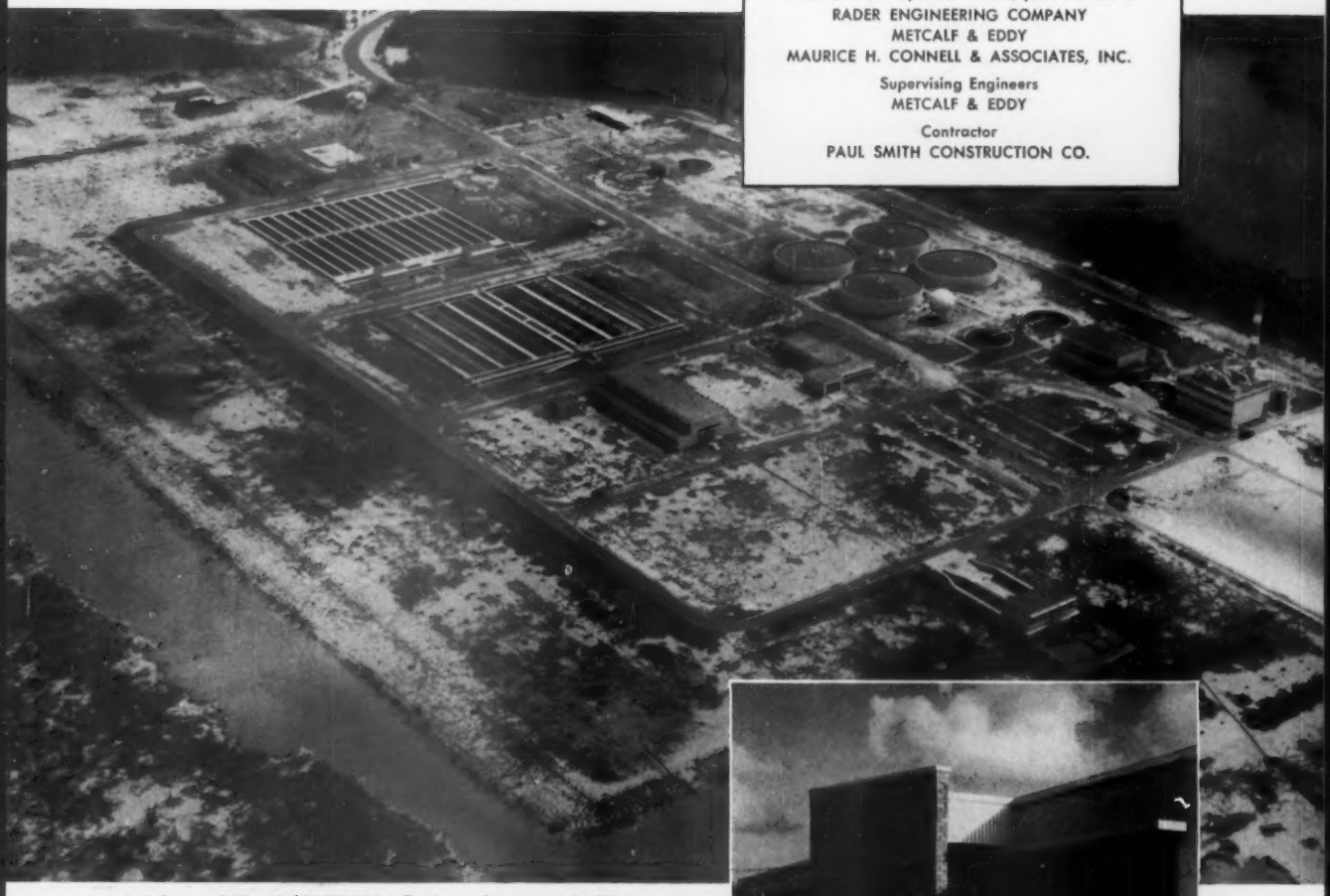
LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. Sanitary Engineering Regional Offices—Colmar, Pa., Chicago 9, Kansas City 8, Mo., San Francisco 24. Sales Offices in All Principal Cities. Export Office, New York 7. Representatives Throughout the World. 15,300

CITY OF MIAMI
SEWAGE TREATMENT PLANT

Design Engineers
Miami Sewer Project Associates; joint venture of
RADER ENGINEERING COMPANY
METCALF & EDDY
MAURICE H. CONNELL & ASSOCIATES, INC.

Supervising Engineers
METCALF & EDDY

Contractor
PAUL SMITH CONSTRUCTION CO.



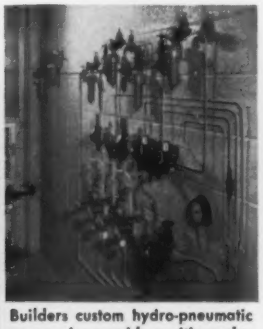
Aerial view of Miami's $27,100,000 collection and treatment facilities shows extensive layout required to rid Biscayne Bay and the Miami River of pollution.

Modern design and layout contribute to the high efficiency of this multi-million dollar plant.

ONE SOURCE
ONE RESPONSIBILITY

Builders self-actuated Rate-of-Flow Controllers at Effluent Water Treatment Plant assure accurate regulation of flows, filter efficiency . . . conserve head.

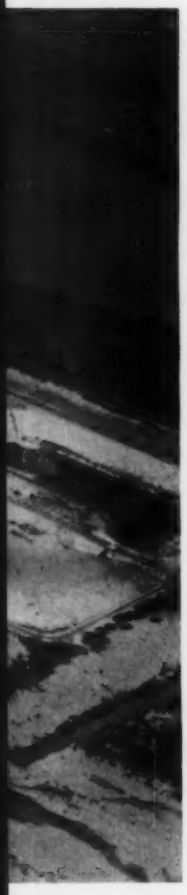
B-I-F *standard* main recording panel which centralizes essential operating data from remote stations.



Builders custom hydro-pneumatic accessories provide positive valve control and are capable of manual operation on loss of air.

Flow rate through Parshall Flume is transmitted pneumatically to several indicators and recorders installed at strategic operating points.

POSITIVE CONTROL OF MATERIALS IN MOTION B·I·F METERS FEEDERS CONTROLS



For New 47,000,000 GPD Treatment Plant...

SINGLE, RESPONSIBLE SOURCE

FURNISHES COMPLETE INSTRUMENTATION,

CONTROL AND CHEMICAL FEEDING EQUIPMENT

B·I·F *Builders-Providence* equipment plays vital role in maintaining Miami's high rate activated sludge type installation at peak efficiency.

Miami's new sewage treatment plant covers a 65 acre site on Virginia Key. A fully integrated control system is needed to centralize the operation of the many functions involved in such a widespread installation.

When this equipment is supplied by a single responsible source, the coordination of efforts during the planning, installation and start-up stages results in immediate and long term savings both in time and money.

Miami, like so many other municipalities, is benefiting from B-I-F's ONE SOURCE — ONE RESPONSIBILITY. For greater system reliability and operating economies, write . . .

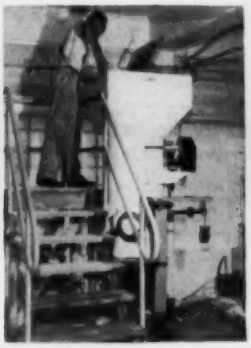
B-I-F Industries, Inc., Utilities Sales, 350 Harris Avenue, Providence 1, R. I.

B·I·F

B-I-F INDUSTRIES

BUILDERS-PROVIDENCE · PROPORTIONEERS · OMEGA

Modern rate-of-flow pendulum-operated diaphragm units provide continuous, dependable flow regulation over 24 to 1 range.

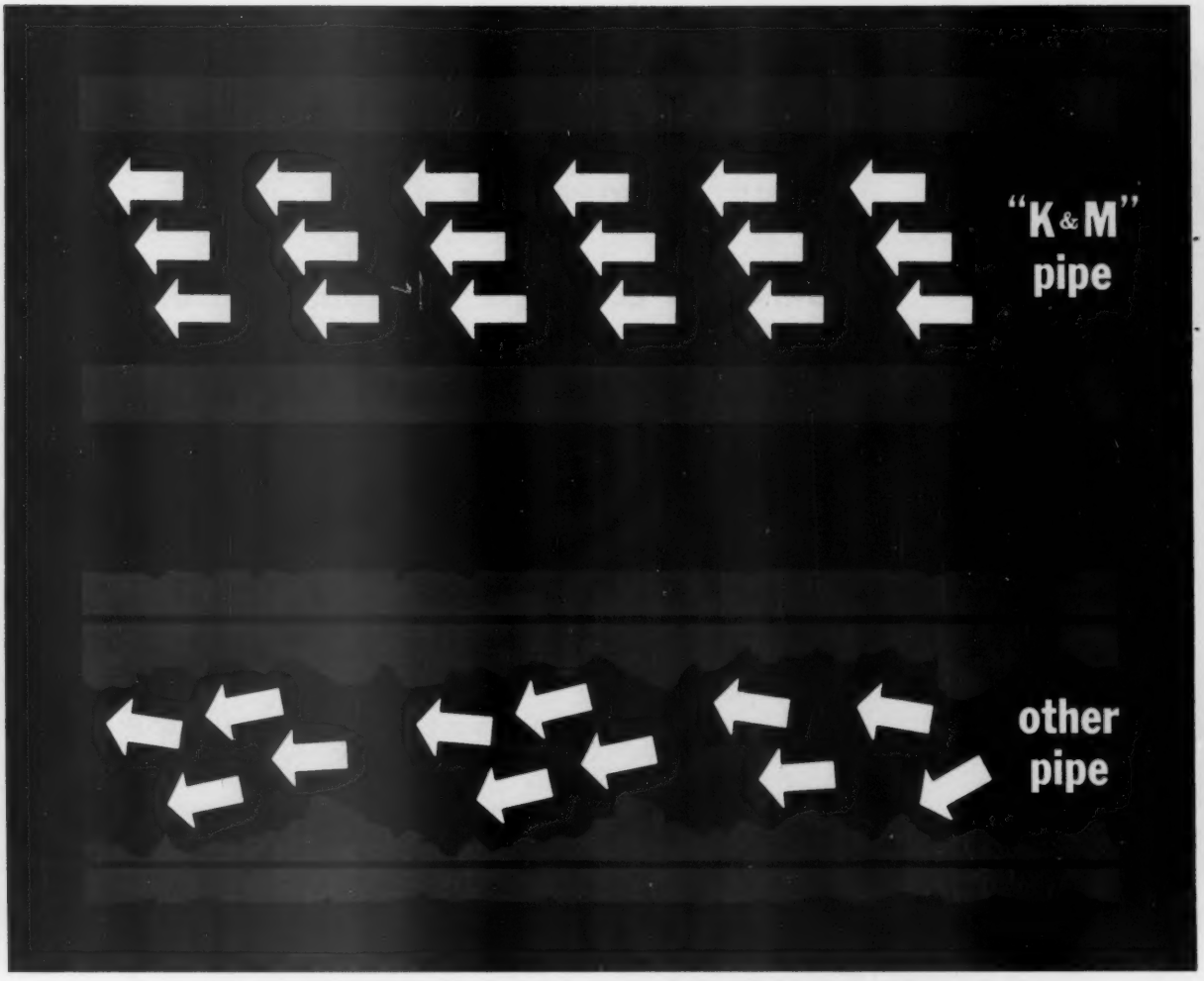


Omega Universal Dry Feeder accurately proportions lime to flow rate of effluent water treatment . . . conserving chemicals and insuring correct dosage despite output variations.

In pipe gallery, operator uses Proportioneers Chem-O-Feeder to add correct dosage of foam control chemicals . . . reliable equipment on standby duty!

Another B-I-F *standard* panel records aeration air, air temperature (wet and dry bulb), digester gas burned by engines, and indicates air to sewage ratio. Wall-mounted summator at right gives *accurate and continuous summations* of air output of four blowers.

Builders Conveyoflo meter accurately totalizes as well as indicates hourly rate of filtered sludge discharged to incinerator. B-I-F supplies a complete line of equipment (meters, feeders, controls) for *positive control of materials in motion.*



Maintenance is practically zero! "K&M" Asbestos-Cement Pressure Pipe is non-electrolytic, non-tuberculating, and corrosion-resistant. Pumping costs remain constant. Never increase with the age of "K&M" Asbestos-Cement Pressure Pipe.

Connections are permanent and water-tight. The FLUID-TITE Coupling gaskets grow tighter as pressure climbs. As water mains fill, the self-energized rubber gaskets expand.

Here's how "K&M" Asbestos-

stretches your

Write to us today for more information on "K&M" Asbestos-Cement Pressure Pipe and FLUID-TITE Couplings.

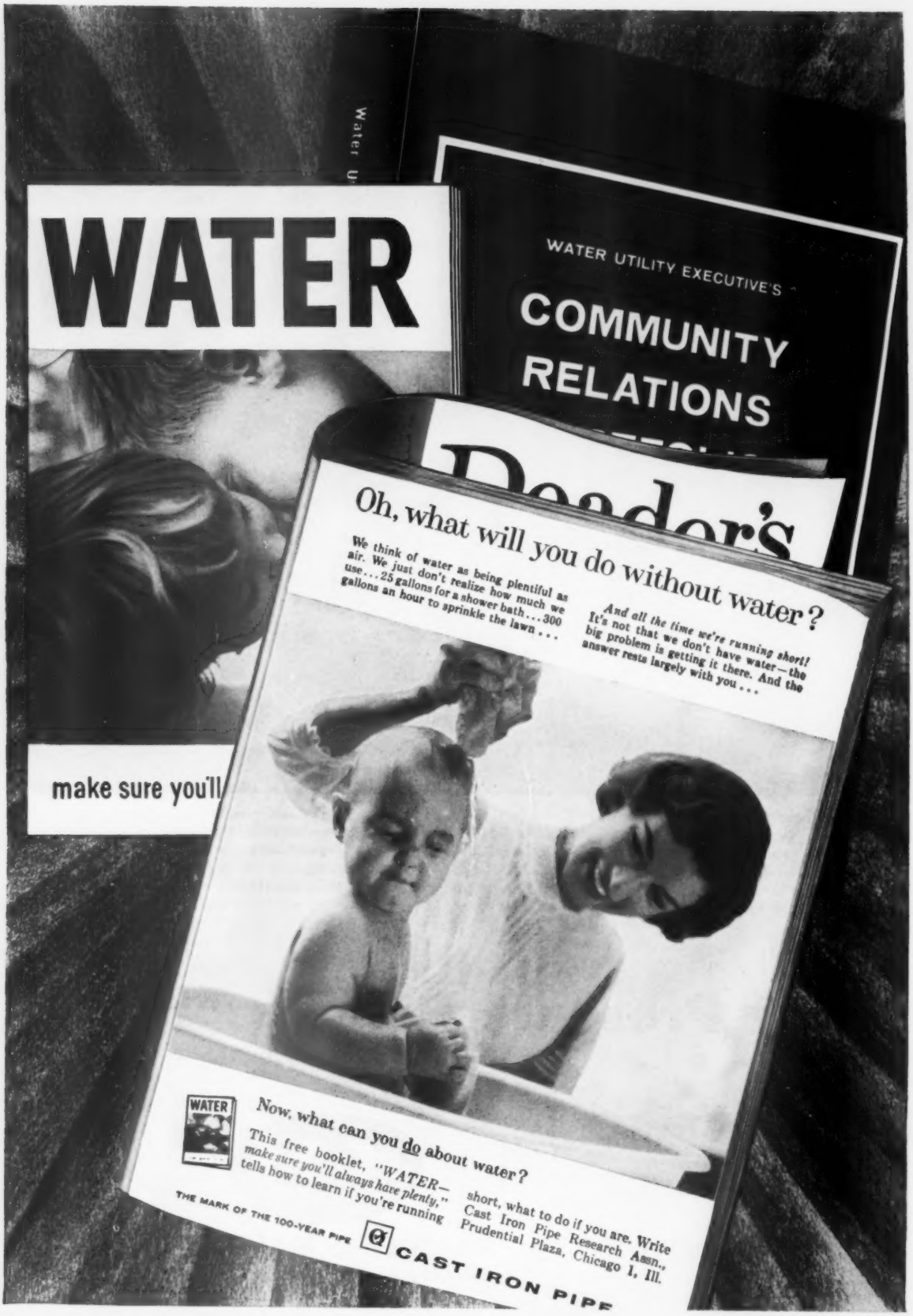
Installation is fast, low-cost! You don't need skilled labor, heavy machinery, feeler gauges or heavy-weight coupling pullers. Neither is the weather an obstacle. Unskilled labor can lay "K&M" Asbestos-Cement Pressure Pipe and FLUID-TITE Couplings quickly and economically. In fact, with the FLUID-TITE Coupling, you can lay more pipe per hour than ever before. To connect, merely lubricate the tapered edge of the gasket in the FLUID-TITE Coupling, then slide in the pipe.

Cement Pressure Pipe

budget further!

K·M
BEST IN ASBESTOS

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA


WATER
WATER UTILITY EXECUTIVE'S
COMMUNITY
RELATIONS
Oh, what will you do without water?
We think of water as being plentiful as air. We just don't realize how much we use... 25 gallons for a shower bath... 300 gallons an hour to sprinkle the lawn...
And all the time we're running short! It's not that we don't have water—the big problem is getting it there. And the answer rests largely with you...
make sure you'll
Now, what can you do about water?
This free booklet, "WATER— make sure you'll always have plenty," tells how to learn if you're running short, what to do if you are. Write Cast Iron Pipe Research Assn., Prudential Plaza, Chicago 1, Ill.
THE MARK OF THE 100-YEAR PIPE
CAST IRON PIPE

PLAN FOR ACTION PROMOTES ADEQUATE WATER SUPPLY

Here's help you can count on

On the opposite page is the third in the current series of advertisements created as a public service by the Cast Iron Pipe Research Association. It's aimed straight at Mr. and Mrs. America through the pages of the widely read *Reader's Digest* magazine.

Similar advertising appears regularly in *U. S. News & World Report, Nation's Business, Better Homes and Gardens, American Home* and *Sunset* magazines.

Every advertisement dramatizes the importance of pure, safe water for home and industry and emphasizes the growing seriousness of the water supply problem. Furthermore, these advertisements *give the reader something to do about it.*

Free Plan-for-Action Booklet

Every reader is offered a free booklet (illustrated on the opposite page) which describes ways for them to get the facts about the water situation in their own communities. A step-by-step outline of action is presented so that, armed with the facts, local citizens can get behind a broad program for extending and improving water service in their own areas.

The third item of assistance offered by the Cast Iron Pipe Research Association to those in the water supply field is a community relations portfolio, also illustrated opposite. It contains ideas and suggestions for public officials to use in their own community relations activities to bring adequate supplies of water to homes and industry in their towns. It tells how informed citizens and officials can work together for improved facilities and adequate rate structures or financing.

This program is already at work—for you. Its impact will be felt more and more as the months go by. For more information and a copy of the booklet, "Water—make sure you'll always have plenty," write to Thos. F. Wolfe, Managing Director, Cast Iron Pipe Research Association, 3440 Prudential Plaza, Chicago 1, Illinois.

THREE REASONS WHY CAST IRON PIPE IS *AMERICA'S GREATEST WATER CARRIER:*

1. More miles of underground cast iron water mains are now in use than of all other kinds of pipe combined.

2. More miles of cast iron water mains are now being purchased and laid than of any other kind of pipe.

3. Impartial surveys prove that today's water utility officials and consulting engineers prefer cast iron pipe for underground water distribution by an overwhelming majority.

CAST IRON PIPE

THE MARK OF THE 100-YEAR PIPE

CONTRACTORS SAY:

"Lower installed costs"

Write for free Transite Pipe data kit. It contains complete information on how Transite benefits the water system designer . . . installer . . . and operator. Address Johns-Manville, Box 14WS, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

JOHNS-MANVILLE

ENGINEERS SAY:

"Pumping efficiency"

MUNICIPAL OFFICIALS SAY:

"Reduces water costs"

FROM DESIGN THROUGH OPERATION—

Transite Pipe never stops saving you money

Read what leading water system designers, installers and municipal officials say about many economies of Johns-Manville Transite Pipe

MAYOR *Walter Reynolds, Providence, R. I. says—*
"An efficient water system ranks high among the many advantages Providence offers industry. Since 1935, Transite Pipe has ably served in the continuing job of keeping our water system more than capable of meeting future needs. In this way our water system contributes not only to the health and convenience of our citizens, but also to the encouragement of industrial and economic growth in our city."

ENGINEER *Philip J. Holten, Jr., Chief Engineer Water Supply Board, Providence, R. I. says—*
"Transite's installation savings have helped us absorb recent increases in labor and material costs . . . Our records show that labor and material costs have increased 100% since 1946. Yet, in this same period of time, our installation costs have increased only 21%. The ease of handling and speed with which contractors can layTransite Pipe enable us to take full advantage of modern equipment and methods. In this way, Transite has played a prominent part in helping us offset increased costs."

CONTRACTOR *C. J. Fanning, Pres. Fanning & Doorley Construction Co., Providence, R. I. says—*
"You soon see why Transite Pressure Pipe saves time and labor when you're working through old, unmarked utility and service lines. These unforeseen obstacles can cause costly slowdowns, but they present fewer problems with Transite. Its flexibility, easy handling and speed of assembly enable our men to work fast even under the most difficult working conditions. And by the same token—your crews really move along when conditions are favorable."

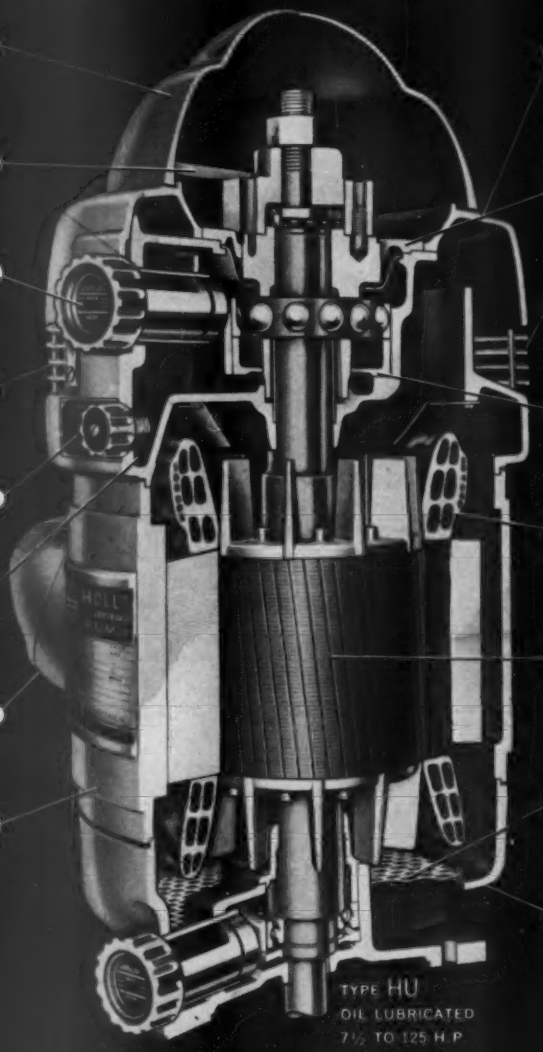
CONTRACTOR *Frederick J. Gallagher, F. J. Gallagher Trenching Co., Tucson, Arizona says—*
"By using Transite Pressure Pipe, we completed this 70,000-ft. water system contract several weeks faster than we had estimated. Transite's ease of assembly keeps our time and labor costs low. We excavate, install the pipe, and button up the trench fast. This speed is especially advantageous when we encounter cross service lines or are faced with bad weather. And always important, it means less annoyance to our own townspeople and the local merchants."

MAYOR *James L. Gardner, Wichita, Kansas says—*
"Every year—we actively go after new business . . . seek new firms to locate in Wichita to create job and business opportunities for our citizens. These new firms need water—and never fail to ask about our water system . . . which is one of the most efficient systems anywhere in the world. Part of its efficiency is made possible by Johns-Manville Transite Pipe which we have been using for many years."

ENGINEER *Leigh O. Gardner, Yost and Gardner, Engineers, Phoenix, Arizona says—*
"Transite has many advantages contributing to its economy. Its light weight, handleability and easy-to-join Ring-Tite Coupling keep our clients' final costs low. We find a continuing economy of operation throughout its long life. We have excavated lengths of Transite after 20 years of service and have found no sign of tuberculation . . . the smooth inside walls proving it still has low coefficient of friction and therefore highest carrying capacity."

Unveiling... U.S. HOLLOSHAFT MOTORS

YEARS AHEAD FOR YEARS TO COME!



TOP COVER
is lightweight, easily removed

UNIQUE LOCK BAR
holds shaft during adjustment

LUBRISCOPE
combined gauge and rapid oil fill

PROTECTIVE GRILLE
prevents entrance of leaves, papers, etc.

OIL CHANGE RECORD
dial indicates date of last oil change

SEDIMENT SUMP
collects grit particles for easy drain

SPLIT TYPE OUTLET BOX
provides easy motor connection

NORMALIZED CASTINGS
maintain accuracy of machining

TOP COWL
motor remains protected during adjustment

BEARING COVER
protects bearing during pump adjustment

LARGE AIR OPENING
reduces intake velocity

PROVISION FOR STACKED BEARINGS
extra heavy thrust easily obtained

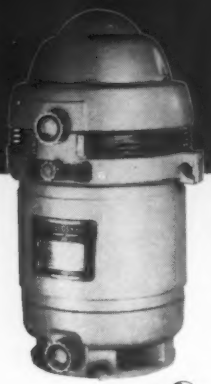
ASBESTOS-PROTECTED WINDINGS
non-carbonizing asbestos extends life

SOLID CAST ALUMINUM ROTOR
with integral fan, provides indestructible structure

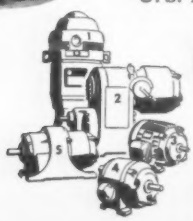
RODENT GUARD
prevents damage due to entry of small animals

IMPROVED WINDING PROTECTION
meets NEMA Weather-Protected Type I requirements

TYPE HU
OIL LUBRICATED
7½ TO 125 H.P.



All new! In Holloshaft Pump Motors, U. S. engineers introduce a new relationship between form and function, as well as many U. S. originated benefit features skillfully translating wishes and suggestions of pump users into practical motor construction. Rugged Holloshaft offers weather protection exceeding NEMA Type I requirements—*plus* enduring, distinctive styling to harmonize with modern pump design. For years-ahead satisfaction, specify: "U. S. HOLLOSHAFT MOTORS."



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OR MILFORD, CONNECTICUT

FREE COLOR BROCHURE
... for full information, send for FREE Holloshaft Bulletin, No. F-1953.

U.S. MAJOR MOTOR LINES INCLUDE:
1. Vertical Solid & Holloshaft, 2. Varidrive, 3. Totally-Enclosed, 4. Uniclosed, 5. Syncrogear. Also, many other special motors.

CONTROL ELM DISEASES WITH OLIVER'S SPRAYING METHOD

The Oliver method of mist spraying is a most effective and economical way of controlling Dutch elm and other diseases, elm leaf hoppers and elm leaf beetles. Oliver spraying units, such as the Model 125 mist sprayer shown above, provide effective control with microscopic droplets that cover exposed surfaces. Only one to three gallons of spray solution is required per large-size tree.

Oliver mist spraying also provides high-coverage protection against mosquitoes, flies and other insects. The spray reaches into remote corners... leaves a residue that protects for a long period.

The other half of the spraying team shown above is the versatile Oliver 550 tractor whose 39 hard-working horsepower and built-in hydraulic system make it the ideal unit for park, municipal and golf course use. Investigate the Model 125 mist sprayer and the Oliver 550 tractor at your nearby Oliver distributor's—soon.

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Industrial Division, 19300 Euclid Ave., Cleveland 17, Ohio
a complete line of industrial wheel and crawler tractors and matched allied equipment

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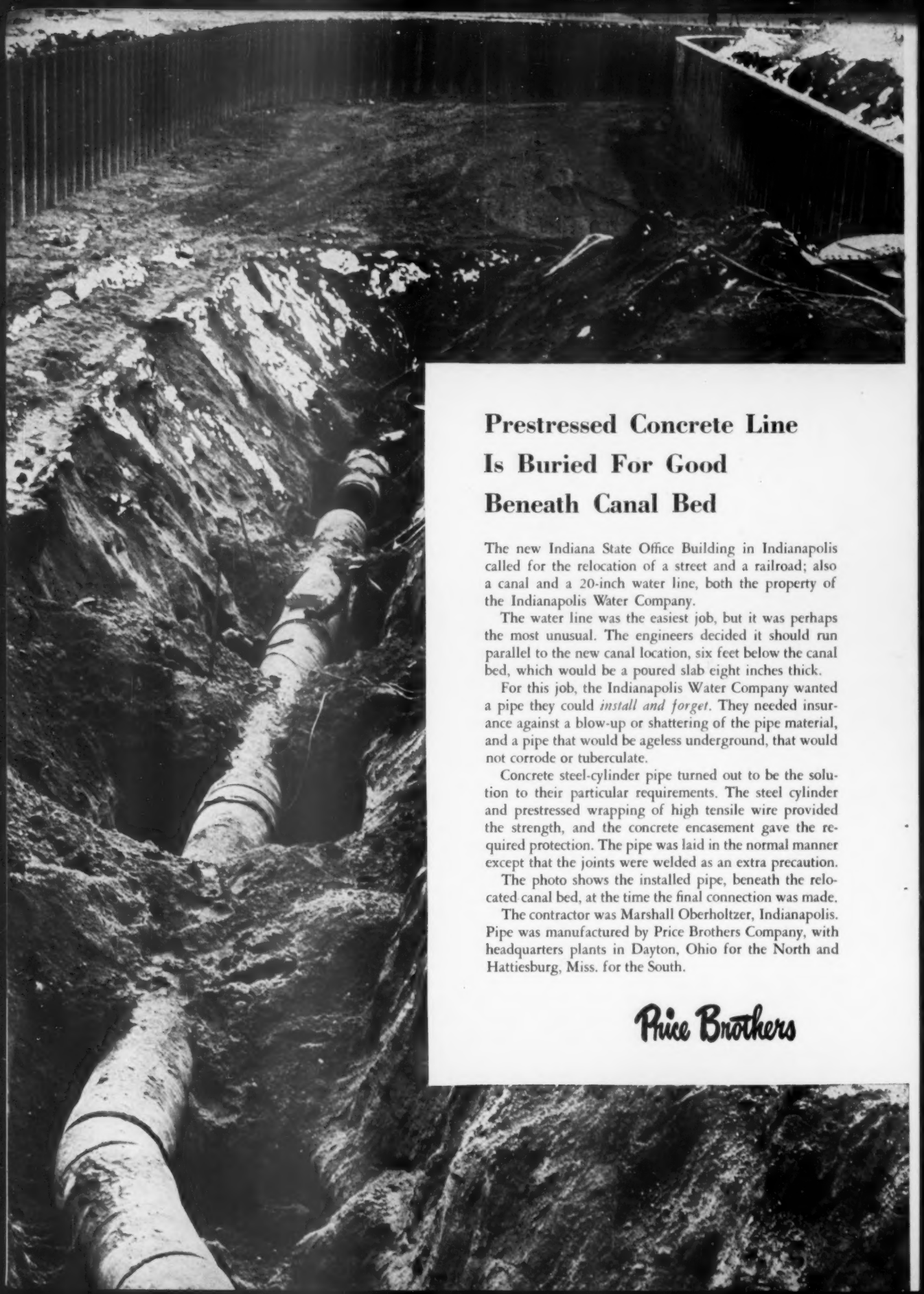


Prestressed Concrete Line Is Buried For Good Beneath Canal Bed

The new Indiana State Office Building in Indianapolis called for the relocation of a street and a railroad; also a canal and a 20-inch water line, both the property of the Indianapolis Water Company.

The water line was the easiest job, but it was perhaps the most unusual. The engineers decided it should run parallel to the new canal location, six feet below the canal bed, which would be a poured slab eight inches thick.

For this job, the Indianapolis Water Company wanted a pipe they could *install and forget*. They needed insurance against a blow-up or shattering of the pipe material, and a pipe that would be ageless underground, that would not corrode or tuberculate.

Concrete steel-cylinder pipe turned out to be the solution to their particular requirements. The steel cylinder and prestressed wrapping of high tensile wire provided the strength, and the concrete encasement gave the required protection. The pipe was laid in the normal manner except that the joints were welded as an extra precaution.

The photo shows the installed pipe, beneath the relocated canal bed, at the time the final connection was made.

The contractor was Marshall Oberholtzer, Indianapolis. Pipe was manufactured by Price Brothers Company, with headquarters plants in Dayton, Ohio for the North and Hattiesburg, Miss. for the South.

Price Brothers

Coordinating "Umpteen" different suppliers

...is costly to you and your consultants

Save Time, Effort, Money with "Teamed" equipment

A multitude of suppliers, each with a product for your project, means endless conference hours coordinating equipment designs, delivery schedules, erection services. It means many extra phone calls, telegrams, voluminous correspondence!

Here's an easy, efficient way to get most of the equipment for your project — pumps, motors, control, condensers, blowers, generators, etc. from *one source*. One inquiry and Allis-Chalmers public works specialists and product specialists coordinate all products to your project design and specifications. Allis-Chalmers assumes sole responsibility for equipment delivery and continuing field service. There's no "buck passing."

Cut out all the waste of time, effort and money involved in coordinating a multitude of suppliers by contacting your A-C representative—or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

"Teamed" Equipment from Allis-Chalmers — Pumps, motors, motor-generators, motor control, condensers, blowers, hydraulic turbines and generators, water conditioning, transformers, switchgear, butterfly valves, diesel engines.

ALLIS-CHALMERS A-C ALLIS CHALMERS

A-5989-PW

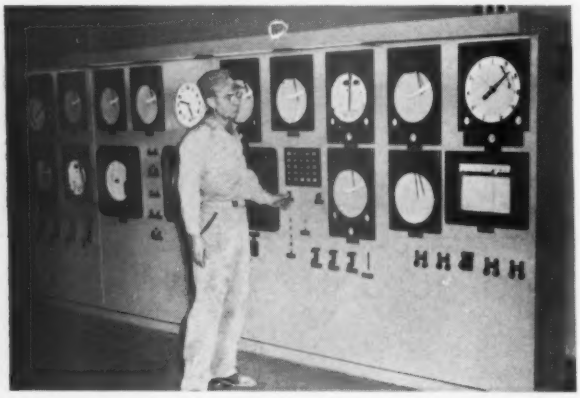
COMPLETE LINE OF CONTROLS

Pneumatic, electric, electronic . . . manual to fully automatic control systems

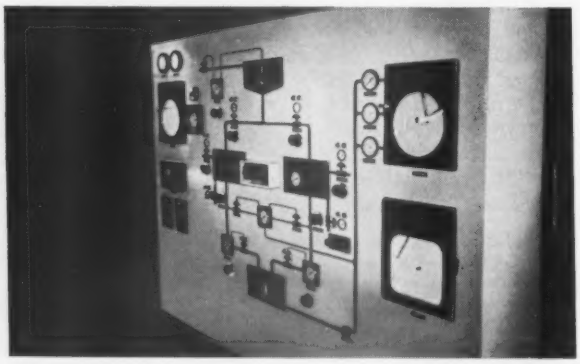
COMPLETE SERVICES

from planning through maintenance are Honeywell "extras."

Manual-pneumatic control system at the Springfield, Ohio, water treatment plant. Black & Veatch, Kansas City, Mo., consulting engineers. G. E. Tillman Co., Inc., Centralia, Ill., general contractors.



Pneumatic-sequencing system at the Fort Hood water treatment plant near Belton, Texas. Freese, Nichols & Turner, consulting engineers. Merritt, Chapman & Scott, general contractors.



Automatic-graphic system at the McAlester, Okla., water treatment plant. Collins & Flood, McAlester, Okla., consulting engineers. Brewer & McMichael, Inc., Holdenville, Okla., general contractors.

Complete services are important extras you get with Honeywell instrumentation. In planning your water projects, you can gain many advantages of these services right now . . . even if your plans are in the pre-blueprint stage. Honeywell services continue through installation of your controls, and long after startup. Here are three ways Honeywell helps you:

THE RIGHT SYSTEM FOR YOU

Honeywell makes *every* basic type of control system, and thus can recommend without bias the very best system for your particular needs. These recommendations are confirmed by product designers, service consultants, and application engineering specialists.

INSTALLATION ASSISTANCE

Honeywell's factory-trained installation specialists can completely install your entire control system, or, if you prefer, supervise installation and startup. Complete operating instructions and service manuals are always provided. Your operators can be trained at Honeywell's tuition-free Instrumentation Education Center.

SWIFT HELP IN EMERGENCIES AND PERIODIC SERVICE

Honeywell has the largest instrument service organization in the world. With a Periodic Service Plan, regular preventive maintenance keeps your instruments in perfect condition. Should an emergency arise, a Honeywell service engineer is always close by.

This is just part of the Honeywell service story. Your nearby Honeywell field engineer will be glad to fill in the details. Call him today . . . he's as near as your phone.

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Smith & Loveless
FACTORY-BUILT SEWAGE PUMP STATION
America's Finest in Design, Service,
Quality and Dependability
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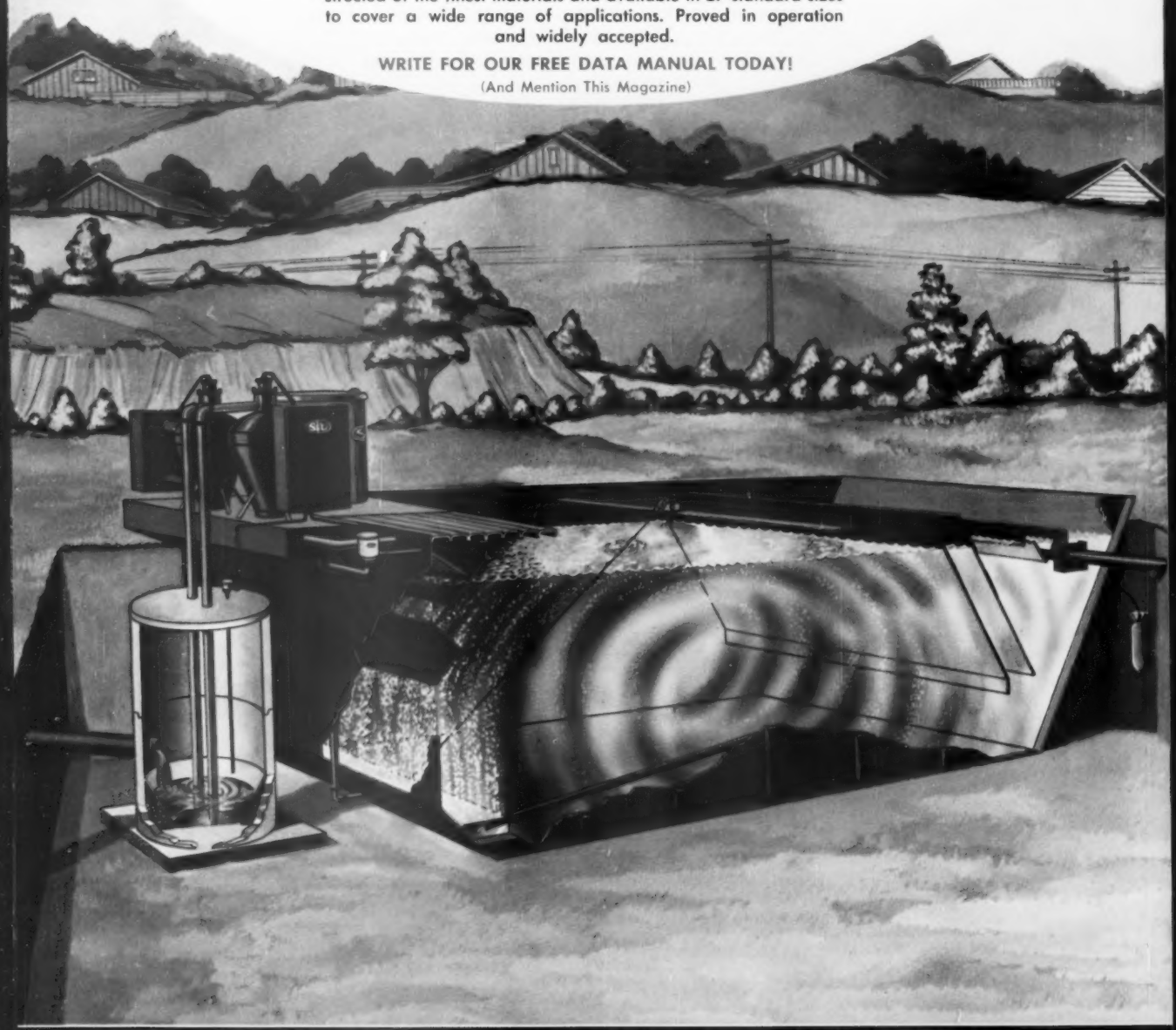

MANUFACTURERS OF WATER AND SEWAGE TREATMENT EQUIPMENT

S&L *Smith & Loveless, Inc.*

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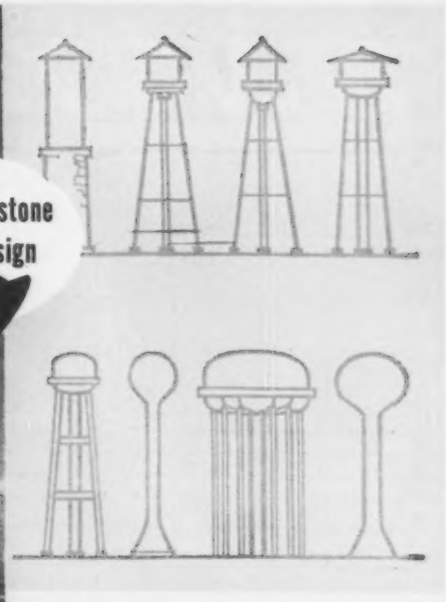

Water needs of growing Pampa, Texas, are served by this CB&I-designed Horton Spheroidal tank. Structure has 1,000,000 gallon capacity, is 76 ft. in diameter, 100 ft. to bottom and has 35 foot range in head. Consulting engineers were Roberts, Merriman & Bowden.

1,000,000-GALLON HORTON® SPHEROIDAL TANK serves Pampa, Texas

When a new tank was needed to provide dependable gravity flow pressure and keep pace with peak load demands in a normally arid, sandy and hill-less region —Pampa, Texas, authorities looked to the experience of CB&I's creative engineers.

The result was a 1,000,000-gallon capacity Horton SPHEROIDAL tank—the newest design in a pioneer family of Horton tanks which date back to 1893. "First cousin" to the Waterspheroid® and "brother" of the Radial-Cone bottom design . . . the Spheroidal tank provides large diameter and a shallow tank depth to store a large volume of water within a low range in head.

The Pampa Story is typical of how CB&I ingenuity continues to serve America's growing need for attractive, tight, *welded steel* tanks that can be designed, engineered, fabricated and expertly erected—to fit local conditions. Write for further information on the *Spheroidal* tank or for the Bulletin on Radial-Cone tanks.

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston • Kansas City (Mo.)
New Orleans • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • South Pasadena • Tulsa
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY, GREENVILLE, PA. and at NEW CASTLE, DELAWARE.
In Canada: HORTON STEEL WORKS LTD., TORONTO, ONTARIO

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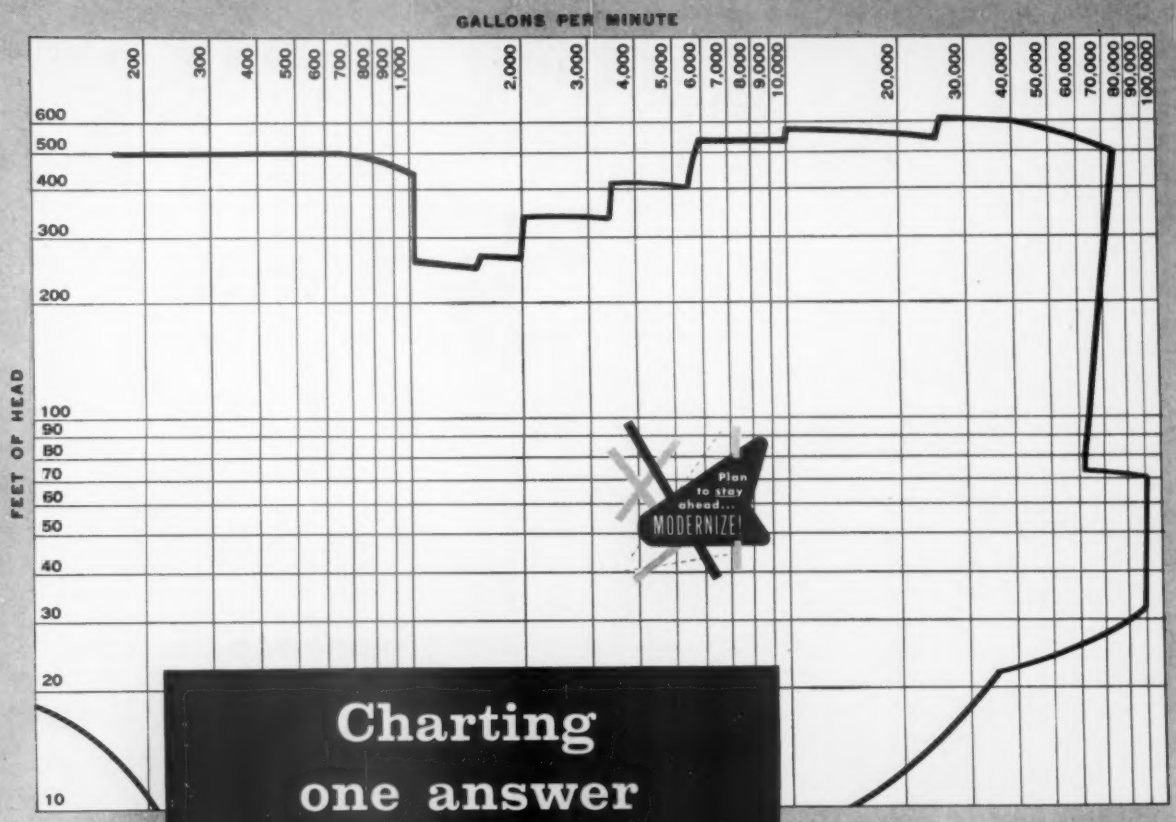
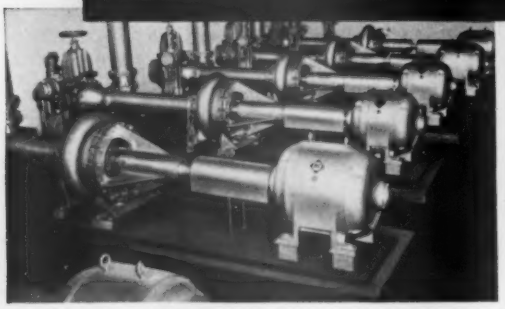
WATERSPHERES® • WATERSPHEROIDS®
ELLIPSOIDAL-BOTTOM TANKS
RADIAL-CONES • SPHEROIDALS
STANDPIPES • RESERVOIRS
HORTONSPHERES® FOR GAS SERVICE

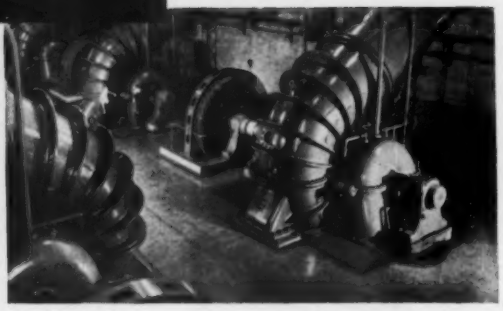
M57C



Charting one answer for every pumping need



Auxiliary service is the job for six 10 x 8 A-C pumps. They are driven by Allis-Chalmers motors.



Main station application involves 12 A-C 72-inch Type SP pumps like that shown.

From the smallest auxiliaries to giant, main system pumps, the range chart for Allis-Chalmers pumping units covers practically every public works requirement. This outstanding one-source equipment availability is a good reason why A-C should be given "first call" in modernizing the pumping facilities of your municipal system.

And complete line is only one "plus" for Allis-Chalmers. Teamed motors and control; customized standardization of parts and materials; engineering assistance and nationwide service are others.

Whatever your need in centrifugal pumps (and A-C builds units even beyond the chart shown), contact your representative or distributor. For additional information, write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

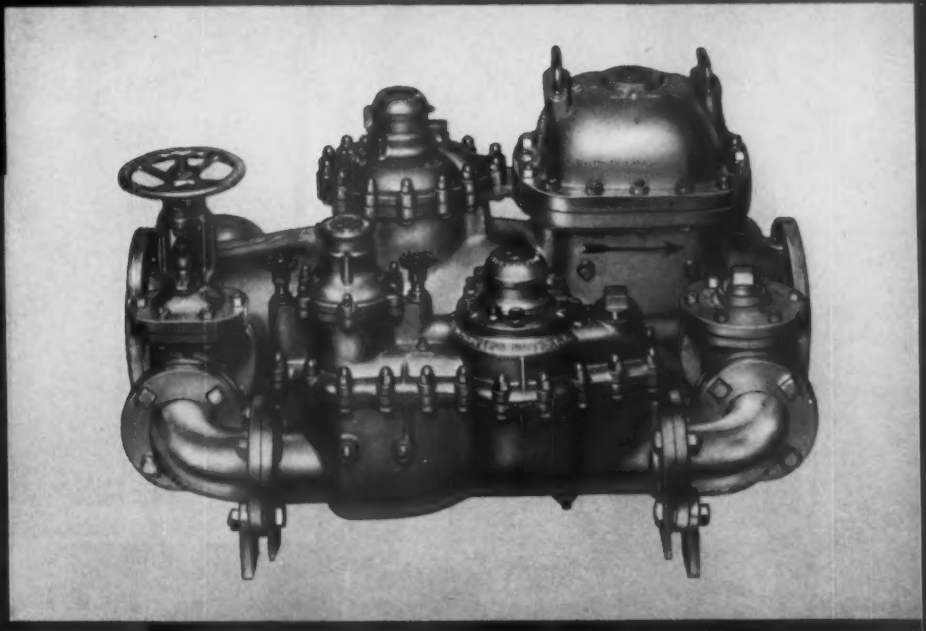
ALLIS-CHALMERS

A-1023-PW

This Counterbalanced Lever Valve is an exclusive, outstanding feature of HERSEY Detector Meters, Compound Meters and Detector Checks. Unequaled for continuous, dependable operation.

HERSEY

DETECTOR (Fire Service) METER



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MANUFACTURING COMPANY

(Established 1859)

DEDHAM, MASS.

BRANCH OFFICES

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SAN FRANCISCO — PORTLAND, ORE. — ATLANTA — DALLAS

"You can't buy a better water meter than HERSEY"

CLOW

UNDER WATER

4-man crew lays 1500 feet a day of CLOW 8" Bell-Tite Joint cast iron pipe through Florida swampland—often in 3 feet of water. Hancock Pipe Co., Clearwater, Fla., contractor.

AT 14° BELOW 0

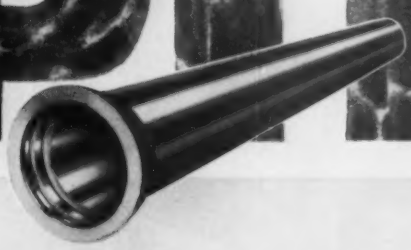
Despite rocky terrain and digging through 2 to 3 feet of frost, workers were able to lay 50% as much 12" Bell-Tite pipe a day at 14 below zero as under normal conditions. Trench was 11 feet deep. Nels Nelson & Sons, Duluth, Minn., contractors.

OR IDEAL CONDITIONS

Laying 2000 feet a day of CLOW Bell-Tite Joint pipe under ideal conditions at Boca Raton, Florida. Reilly-Bates Corp., Pompano Beach, Fla., contractors. Black & Associates, Gainesville, Fla., consulting engineers.

CAST IRON

PIPE

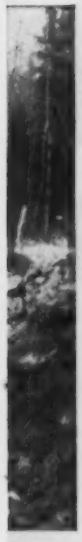


PROVED...

CLOW Bell-Tite® JOINT

CAST IRON PIPE

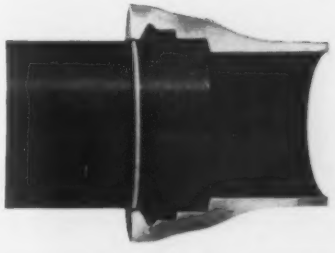
saves time and money under all installation conditions



Clow Bell-Tite Joint costs less to buy and less to install. Assembly is easy and rapid and the rate of installation depends only on the speed with which the trench can be excavated.

A single molded rubber gasket is the only accessory required. No bolts, no nuts, no followers, no couplings, no extras to buy. Clow Bell-Tite pipe is available from 3″ to 24″ in any thickness or weight in accordance with ASA, AWWA, or Federal specifications.

Clow Bell-Tite Joint is easily assembled—just wipe clean, lubricate and push spigot into the bell. When painted yellow stripe is no longer visible, joint is pressure tight.



OUR 81st YEAR
1878 • 1959

It will pay you to know the savings in time and money CLOW Bell-Tite Joint Cast Iron Pipe makes possible. Let us give you complete information on its many advantages.

CLOW CAST IRON PIPE

JAMES B. CLOW & SONS, INC.
201-299 North Talman Avenue, Chicago 80, Illinois

Subsidiaries:

Eddy Valve Company
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Iowa Valve Company
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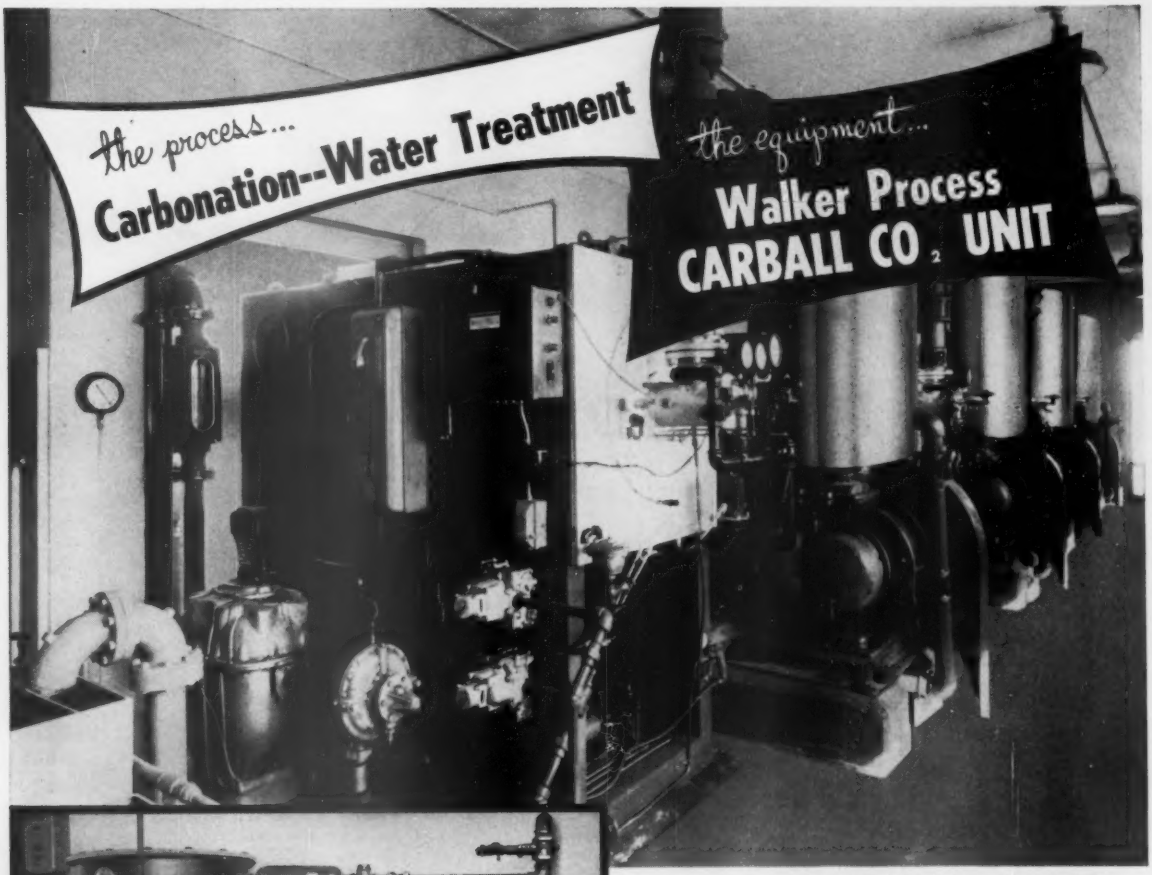

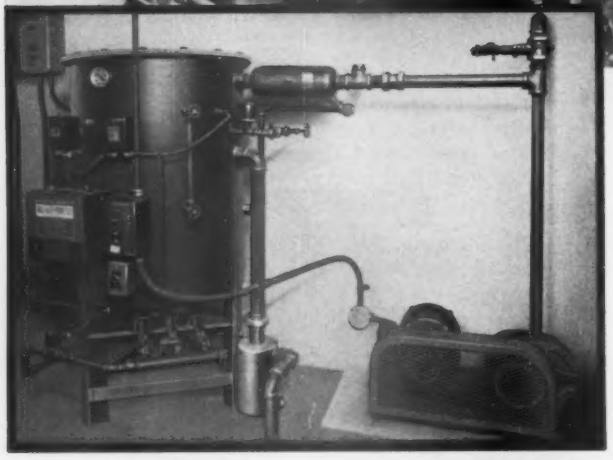

Four size 4 Carballs at Kansas City, Mo. burn either gas or oil to produce max. of 40,000 lbs. CO_2/day. Size "O" unit at left produces 570 lbs. CO_2/day for Jefferson, Iowa Water Plant.

CARBALL
CO_2 UNIT

Walker Process now offers carbonation units for all lime softening plants from the very small to the largest. Sizes range from the new "OO" unit with minimum capacity of 55 lbs. CO^2/day to the No. 4 at maximum output of 10,000 lbs. CO^2/day.

Engineers can readily provide an entire carbonation system by simply specifying the appropriate size CARBALL in combination with Walker Process SPARJER diffusers . . . . . assuring

50% More CO^2
Clean, Tasteless Gas
100% Combustion
Unique Absorption Method
Economical Operation
Factory Tested Package System

Write for bulletins 7W83 - 7W85 and 7W88

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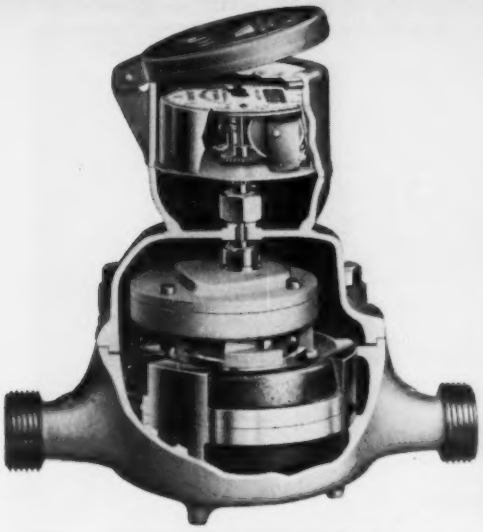
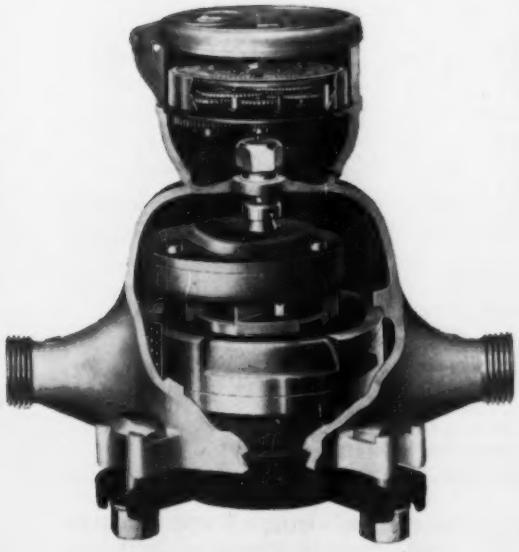
WALKER PROCESS EQUIPMENT INC.
FACTORY • ENGINEERING OFFICES • LABORATORIES
AURORA, ILLINOIS

Rockwell disc meters are made and tested to exacting standards in this modern $2-½ million water meter plant. Warehouse stocks at key locations across the country provide prompt, off-the-shelf delivery.



Tropic Type



Arctic Type

THE BEST DISC METERS YOU CAN BUY

For all these good reasons

Rockwell disc meters are made with costly *stainless steel trim* to assure corrosion resistance and durability. Their construction includes a patented *"O"-ring stuffing box assembly* which stops leaks, binds, troubles and expense. Another extra value is the *large red center test hand* on all registers which provides a closer check on accuracy and a convenient means for determining leaks on customer's premises. And even parts for Rockwell disc meters are neatly packaged in convenient quantities to stack on shelves—eliminate the need for bulky bins—simplify inventory control and reordering. All this adds up to better disc meter values and service for you. Write today for latest bulletins. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

DISC TYPE WATER METERS

another fine product by

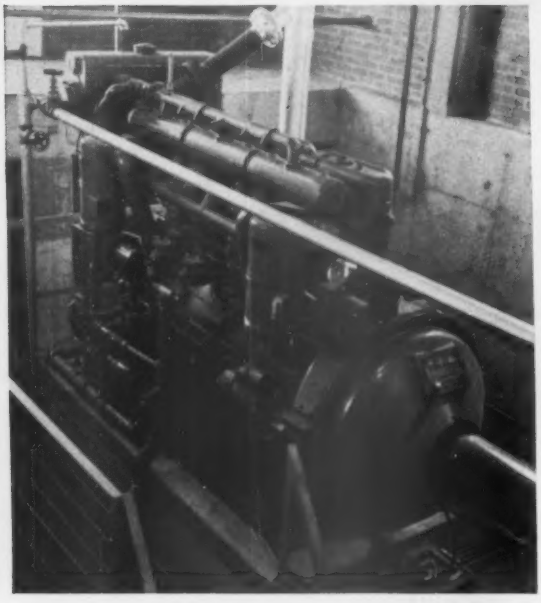
ROCKWELL

ROILINE ENGINES (Formerly LE ROI)

* The trade mark LE ROI is used under license from Westinghouse Airbrake Co., the trade mark owner.

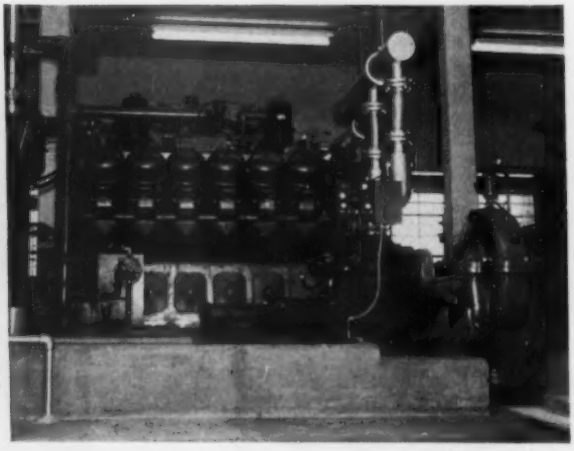
POWER FOR MUNICIPAL PLANTS

Three ROILINES pull the pumps at Oklahoma City's Lake Hefner Municipal Filtration Plant.



Model F-1500, maximum horsepower 215 at 1200 rpm on natural gas.

Model L-3460, maximum horsepower 595 at 1350 rpm on natural gas.



BASIC ENGINE CHARACTERISTICS*

GASOLINE OR NATURAL GAS					600	800	1000	1200	1400	1600	1800	2000	2200	2400
MODEL	Bore & S.	Cyls.	Displ.	Torque–rpm	BRAKE HORSEPOWER AT ENGINE SPEEDS INDICATED									
H540	4½ x 4¼	8	540	430- 900	...	64	82	99	115	130	143	155	164	170
H844	5¼ x 4⅞	8	844	637-1500	...	106	135	165	191	215	237	255	270	278
F1500	6¾ x 7	6	1503	1090- 650	125	165	200	215						
H2000	6¾ x 7	8	2004	1485- 650	170	225	270	290						
L3000	6¾ x 7	12	3006	2200- 650	250	335	405	435						
L3460	7¼ x 7	12	3468	2570- 900	285	391	492	568	595 @ 1350 RPM					
L4000	7.54 x 7.5	12	4000	2930- 900	325	446	560	645						

*With oil pump, water pump, magneto, air cleaner, carburetor, and exhaust muffler. Hp shown is maximum.

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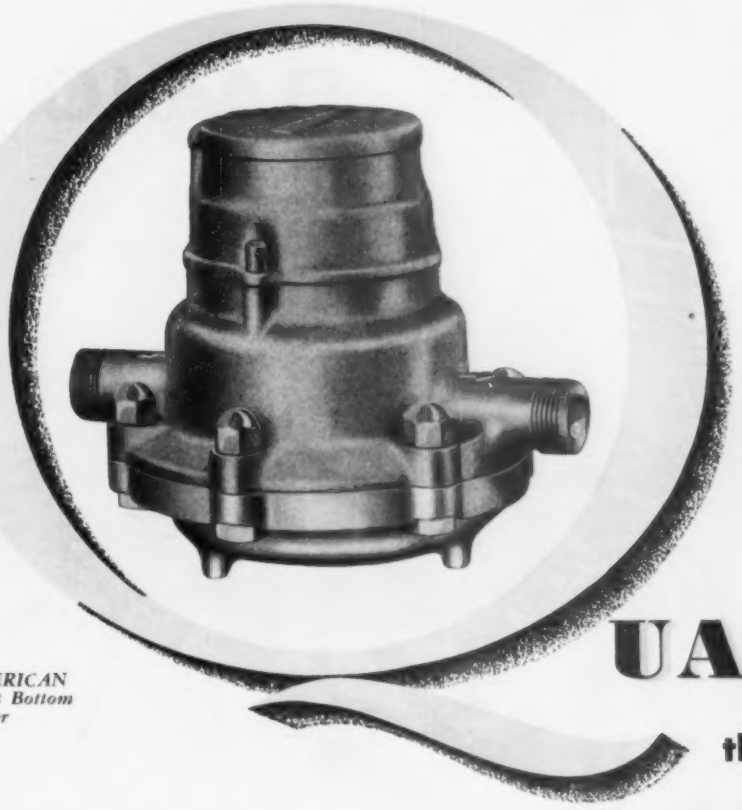

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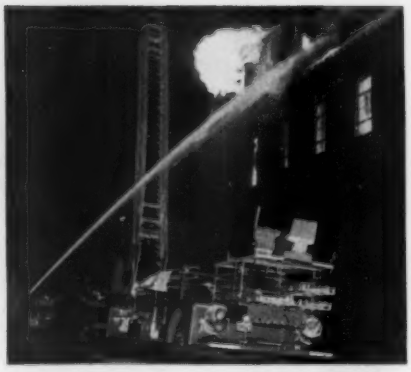

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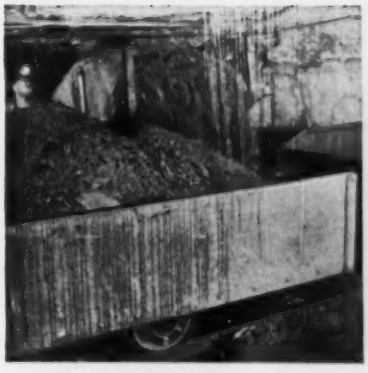

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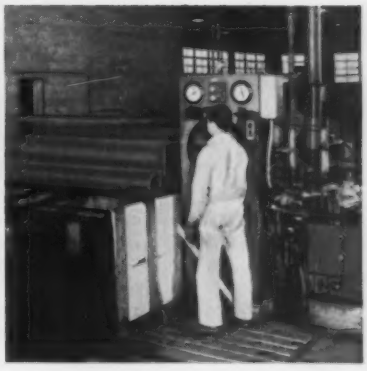

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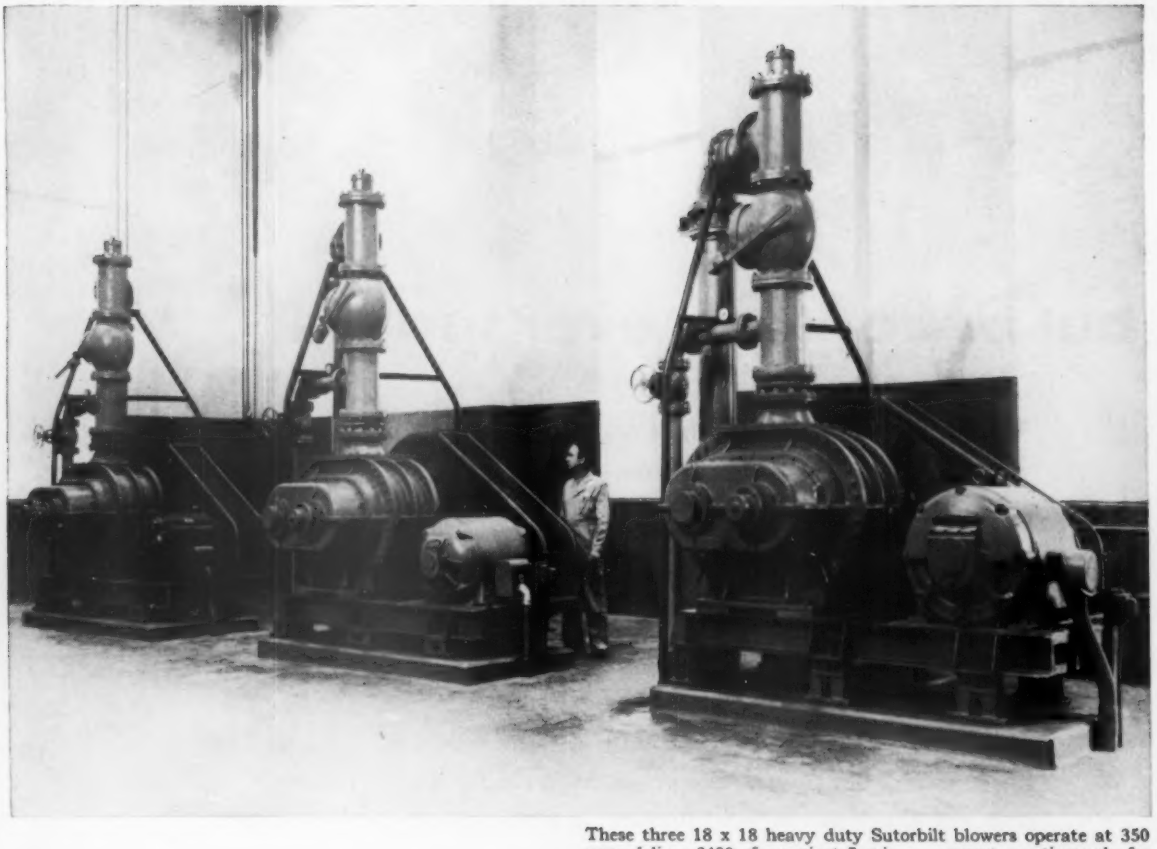

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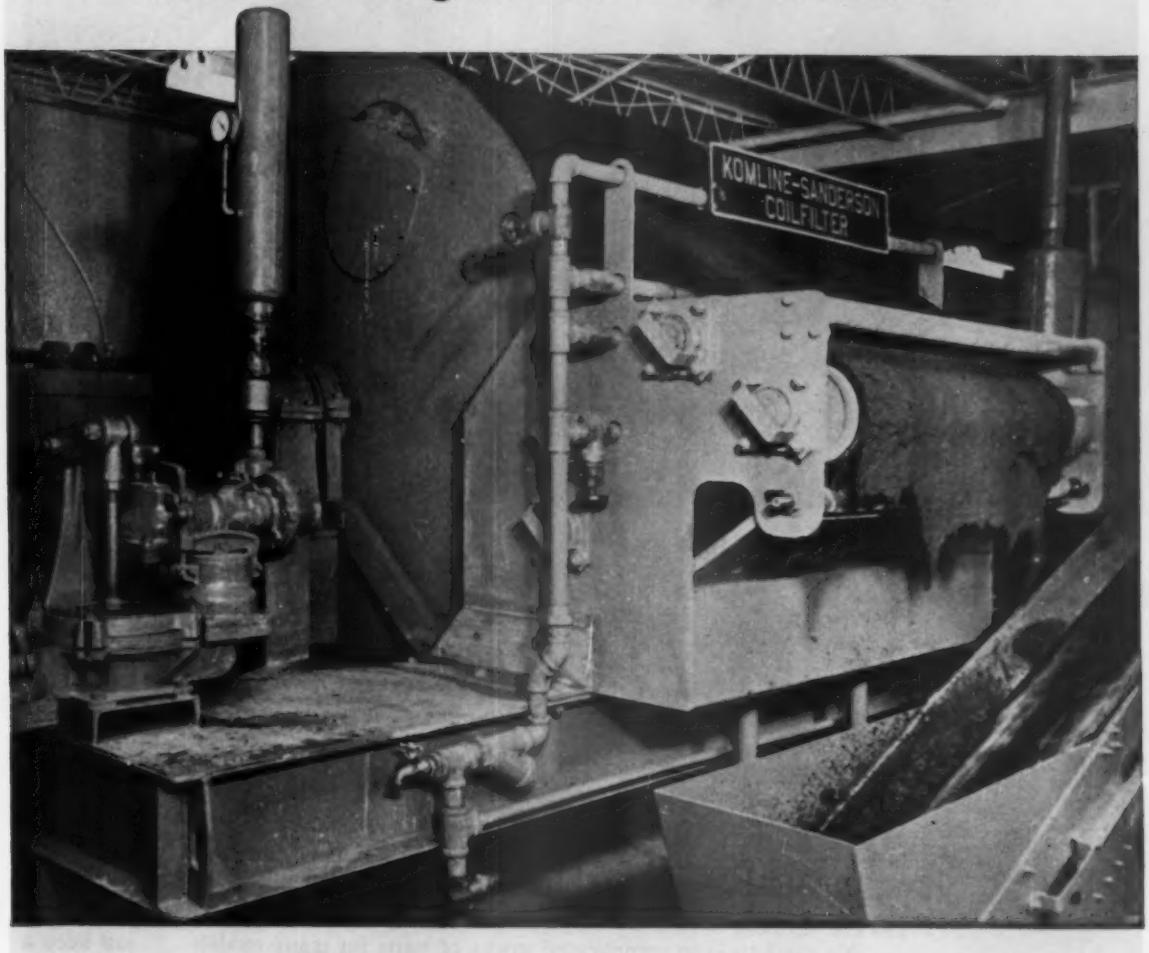

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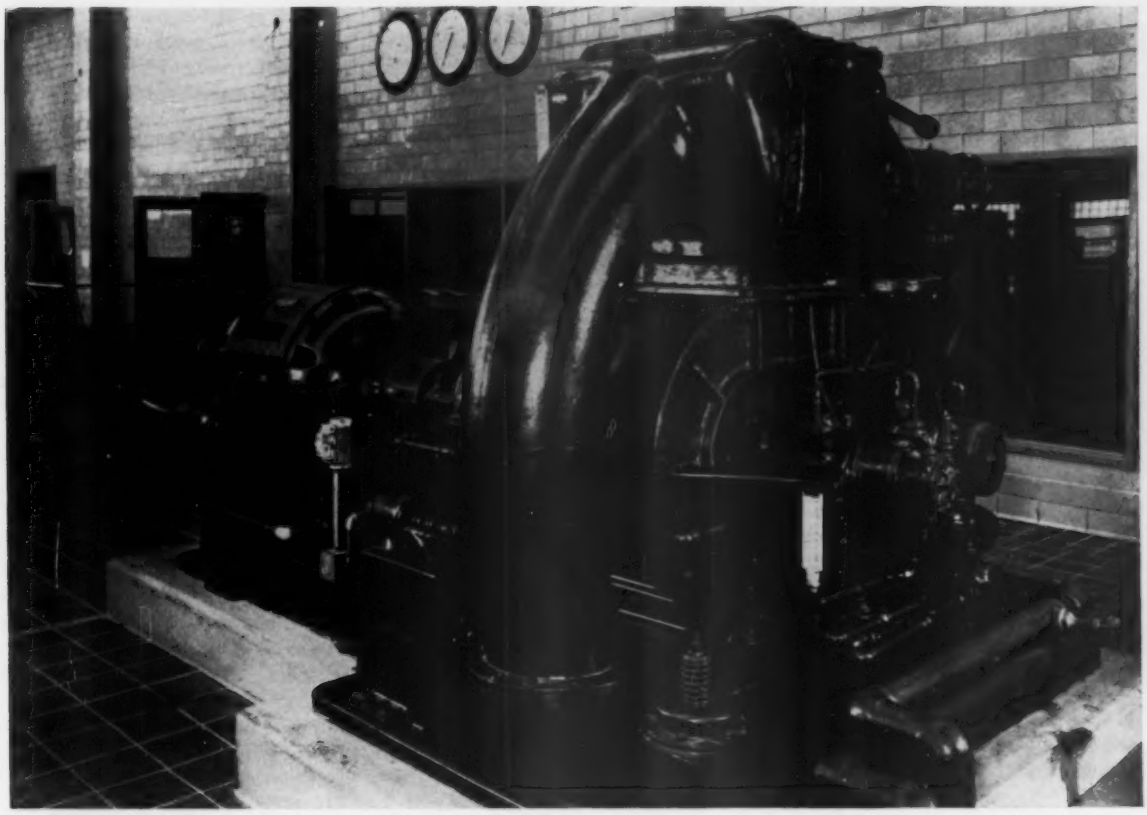
WATER & SEWAGE WORKS



DUAL IMPELLER rotary blowers at Rockaway sewage plant, Long Island, N. Y. illustrates considerations to be given to . . .

Blower Characteristics, *Selection and Maintenance*

by G. R. KUNZE, Chief Application Engineer
Roots-Connersville Blower
Connersville, Indiana

EDITOR'S NOTE: The basic characteristics of the blower used in sewage treatment plants are discussed as they relate to blower selection. In addition the paper which Mr. Kunze presented at the Indiana Sew. & Ind. Wastes Assn. meeting outlines a basic blower maintenance program.

■ THE LOW PRESSURE AIR supplied for aeration in sewage treatment must meet three requirements; it must be clean, essentially dry and oil free. The preferred equipment for supplying air meeting these requirements is either a rotary positive displacement or a centrifugal blower.

Blower Types

The rotary positive displacement blower as the name implies delivers a definite quantity of air per revolution. It can be characterized as a constant volume variable pressure machine. For all practical purposes, the delivered volume does not vary, regardless of air temperature, barometric pressure and discharge pressure. The power required is also independent of atmospheric conditions and varies directly as the discharge pressure.

A centrifugal blower is a dynamic type machine in which the air is compressed by converting the velocity head developed by the impellers to pressure head. The pressure developed will vary with changes in air density, so that at lower temperatures, because of increased density, higher pressures will be developed; or, at higher temperatures, lower pressures will be developed. Assuming that the inlet conditions remain constant, the inlet volume to the blower varies as the required discharge pressure. For example, if the pressure requirement is increased, the centrifugal blower will meet the requirement, but will handle a reduced volume of air. On the other hand, if the pressure required is reduced, a larger volume will be handled at the reduced pressure.

Positive Displacement Blower Selection and Accessories

Positive displacement blowers are built in sizes from approximately 5 cfm to 30,000 cfm at the pressures normally encountered in sewage aeration. With present design, the maximum practical size is approximately 21,000 cfm. Good design suggests that blowers be installed in multiple units so as to provide flexibility in operation and stand-by if needed. It is recommended that the blower be sized such that the maximum air demand can be met with the single largest machine out of service. Since the volume can only be varied by varying the speed of a positive displacement blower, it is well to select units of different size to provide volume increments without speed variation. This is particularly advantageous in the larger sizes where speed variation is both difficult and expensive.

Since the positive displacement blower will deliver a constant volume regardless of pressure, to protect the blower and its driver, a relief valve is necessary to prevent excessive build-up should the discharge from the blower be restricted. The two types commonly used are spring loaded or dead weight loaded. In either case, the valve should be of sufficient size to relieve the full capacity of the blower without allowing the pressure to rise to the point at which it will damage the blower or driver. While many elaborate relief valves are available, it is usually conceded that the simplest and least complicated valve can be depended on to provide relief protection when it is needed. In addition whenever more than one blower is connected to a system, it is absolutely necessary to provide a check valve between each blower and the discharge header. A blower if supplied with air at sufficient pressure and in sufficient volume may rotate backward at a higher speed than it was designed for in forward operation. Needless to say, this can cause serious damage.

To provide plant personnel with information relative to the functioning of the blower equipment, a pressure gauge of the mercury monometer type located at the blower is the most important. This permits the operator to check diffuser operation at a glance and also make certain that the blower is operating within its design rating. In addition to pressure, it will be necessary to determine the rate at which air is being supplied to the process. If the blower operates at constant speed, the rate will, of course, be known. If the blower operates with variable speed, a tachometer should be included, which will indicate or record the rate of flow for any speed condition. In either case, it is often desirable to equip the blower with an integrating revolution counter which will totalize the air delivery over a period of time. The foregoing methods for determining air delivery rate are more accurate than an orifice type air meter unless provision is made to prevent the pulsating flow from giving erroneous readings.

Air pulsation and the resulting noise characteristic of positive displacement blower become more pronounced at higher blower speeds and with larger blowers. Pulsation snubbers and silencers are therefore an important accessory, particularly in multiple blower installations. Where two or more blowers discharge into the same header, an annoying and detrimental resonant condition can exist. Likewise, the inlet of a blower may cause objectionable noise which may be effectively removed with the proper silencer. Silencer and pulsation snubber selection, design and location is very important and should be done by those qualified in this type of engineering. Proper selection and location can make the difference between a mediocre and a satisfactory blower installation.

Centrifugal Blower Selection

Economic considerations, mainly of first cost, indicate in general that centrifugal blowers should be considered if the size of a single blower is to be larger than 20,000 cfm and if the utilization of sewage gas for power generation is not being considered. The operating characteristics of the centrifugal blower are:

1. It is essentially a constant pressure machine.
2. The pressure developed varies with inlet air density.
   a. At a lower temperature, a higher pressure will be developed.
   b. At a higher temperature, a lower pressure will be developed.
   c. A lower inlet pressure will result in a lower discharge pressure, and a higher inlet pressure will result in a higher discharge pressure.
3. Delivered volume varies with pressure. At a fixed speed, the volume decreases with an increase in discharge pressure and increases with a decrease in discharge pressure. Volume may be varied at constant pressure by throttling at the inlet; however, some power is lost by this method. Automatic or manual devices known as adjustable inlet guide vanes, which are lo-

Table I

Resume of Blower Characteristics

Positive Displacement	Centrifugal
1. Constant volume — variable pressure characteristic.	1. Constant pressure — variable volume characteristic.
2. Most desirable and economical for volume from 5 to 20,000 CFM per machine.	2. More economical for volume over 20,000 CFM per machine.
3. Extremely adaptable to any type of drive.	3. Limited to constant speed electric motor drive.

cated at the inlet to the first impeller, permit volume regulation at constant pressure with a saving in power consumption. Speed regulation may also be used to change the volume and pressure rating by using a wound rotor electric motor or a variable speed coupling.

4. The minimum volume obtainable at constant speed is about 50% of the design volume before the blower reaches an unstable condition known as "surge." Operation near or below the "surge" point can result in damage to the equipment.

Therefore in selecting a centrifugal blower, a thorough study of the operating conditions is required to make sure that the blower will be large enough to meet the job requirements under any expected condition of operation. Adequate protection against "surging" should be provided when there is a possibility that a discharge pressure can be developed by the system in excess of that which the blower can produce.

The blower should be selected on the basis of the hottest day of the year, the lowest barometer and the worst condition of diffuser clogging which would result in the maximum discharge pressure. Since this condition will rarely if ever exist, regulation, either manual or automatic, must be provided.

Filters and Unloading Valves

To provide a complete blower installation, certain other accessory items are required. Since clean air is an absolute necessity, an air filter should be provided to remove the dust and dirt which is present in the atmosphere in varying quantity. Where the air requirements are moderate an oil-wetted, impingement type of filter is used. It is quite similar to the type used in automobiles. The most economical filter of this type is arranged so the filter element can be washed and re-oiled. Spare filter elements are usually furnished so that a clean one can be inserted and the dirty one washed and oiled when time permits.

For larger air requirements, there are numerous automatic or semiautomatic air filters available. These operate either on the impingement principle or are of the electro-static type which cause the dust particles to take on an electrical charge and then be attracted to an electrode of opposite charge. The principle can be likened to a magnet.

It is good practice to install an unloading valve in the discharge line to permit starting the blower unloaded. Butterfly or gate valves are commonly used for this purpose. At times it seems desirable to pipe the outlet of the unloading valve back to the blower inlet to reduce the noise caused by air rushing through the valve. Such an arrangement has an inherent danger as it makes it possible to return compressed and heated air to the blower inlet if the valve is left partly open. Such a procedure, if allowed to exist, can result in serious over-heating of the blower. The safest method is to let the air exhaust into the room or into a stack.

Blower Maintenance

The effectiveness of maintenance is only as good as the plan which should be established when a piece of equipment is installed. Without a planned maintenance program, continual difficulties can be expected, usually occurring when the equipment is most needed. Therefore a good maintenance program should consist of periodic inspections performed in accordance with an established routine. A minimum program should include at least the following points to be checked at reasonably short intervals:

1. Lubrication, oil pressure, temperature and leaks.
2. Discharge pressure.
3. Inlet pressure (pressure loss through air filters).
4. Unusual noises or behavior.

Points to be checked at longer intervals are:

1. Condition of the lube oil.
2. Condition of the lube system with respect to filters and coolers.
3. Condition of the bearings and gears.
4. Condition of the rotating elements with respect to wear, contact, the appearance of premature cracks and similar defects.

In addition to the inspection program just described, planned shutdowns should be made at which time a more thorough inspection of all major parts can be made. Quite often latent defects or impending trouble can be discovered and steps taken to correct the trouble before it results in an emergency shutdown or operating failure.

It is not intended to imply that air blowers are fragile pieces of equipment or any more susceptible to wear and failure than other types of equipment. However, they usually represent the largest investment in any single type of machinery and are, of course, the heart of the activated sludge treatment plant. As such, it is good plant management to see that they receive their share of attention.

A Book for Everyone's Library

Ion Exchange Resins by Robert Kunin is a second edition which is 50 per cent larger than his original edition. The second edition contains new material on synthesis of resins, atomic energy fields, ion exchange resins in agriculture, hydrometallurgy, stability of ion exchange resins, permselective membranes, liquid ion exchangers and catalysis.

The material on theory, test procedures, ion exchange resins for sugar and economics of ion exchange has been rewritten.

The book provides detailed descriptions of the nature and preparation of all kinds of ion exchange resinous materials. It shows how to synthesize an ion exchange resin, evaluate the product, and employ the resinous material for both major and minor applications.

The new edition draws on the author's many discussions with leaders in the field throughout the world, his lectures to students, and his experience in training chemists in industry. The book provides a well rounded and up-to-date picture that cannot be gleaned from the widespread and obscure literature. Many topics which were only lightly touched upon in the first edition have become so important as to require greater expansion, sometimes an entire chapter. The second edition also covers many aspects which only recently have begun to appear in the literature because of A.E.C. declassification codes. The book has 467 pages and is available from John Wiley & Sons, Inc., 440 4th Ave., New York 16, N. Y., at a cost of $11.00.

A new method of water treatment involves the use of . . .

Fatty Oils *for odor removal*

by C. BOELHOUWER, R. SYDERIUS, M. TELS and H. I. WATERMAN, Technical Univ. of Delft, Holland

EDITOR'S NOTE: Dr. H. I. Waterman, Head of the Dept. of Chemical Technology at the Technical Univ. of Delfts, Holland in collaboration with his assistants, has written two articles dealing with a new method for the purification of surface water.

This article submitted by Dr. John C. van Dyk of van Dyk Laboratories, Morris Plains, N. J. is the first of these articles; the second concerns an analysis of the removal of tastes or taste causing contaminants by a method involving the use of fatty oils.

■ IN HOLLAND, as in many other countries, population increase and industrialization have led to large scale use of river water for industrial and domestic purposes. Stream pollution due to sewage and wastes disposal has become a serious problem. For these reasons an urgent need exists for efficient water purification methods.

One of the authors[1] has shown that several antiseptic comounds, for instance phenol and related substances, are much more soluble in fatty oils and fats than in water. Small amounts of phenolic compounds give a disagreeable taste and odor to water. It was expected that other substances, affecting the taste and odor of water, might behave similarly. In the experiments described below it was found that the taste and odor of surface water may indeed be improved by treatment with a fatty oil.

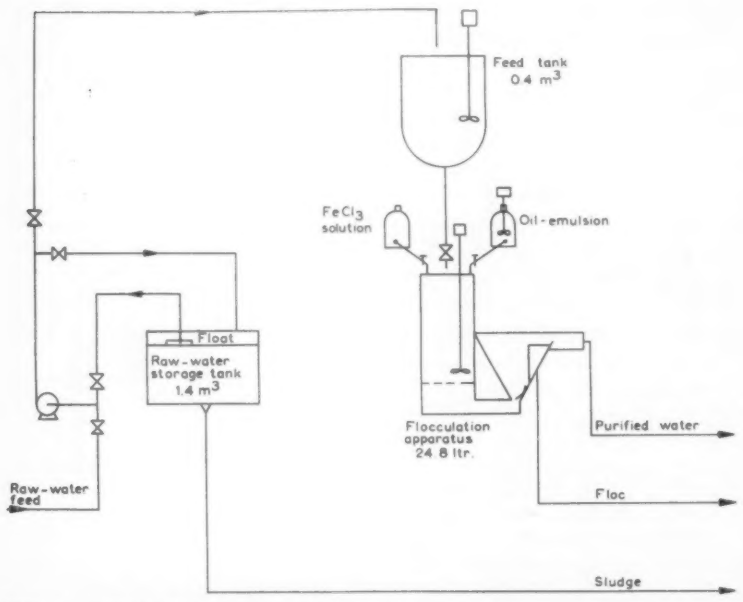


FIG. 1—APPARATUS for continuous water purification.

Preliminary Experiments

Water was taken at low tide from the river New Meuse (in the delta of the river Rhine) somewhat upstream from the city of Rotterdam. Samples were taken after a 12 hr sedimentation. To 3 liters of sample were added 60 mg of sesame oil. The oil was emulsified by stirring. In other experiments the same amount of oil was added as an emulsion, prepared with water separately. The oil was removed from the water by adding ferric chloride (12 mg/L of Fe^{+++}) and flocculating ferric hydroxide at pH values of 6 to 8. A satisfactory type of floc was obtained. The floc could be separated by sedimentation or filtration. The filtrate was clear. The odor and taste of the water were much improved by this treatment.

The wet, oil bearing precipitates were steam distilled in an all-glass apparatus. The first milliliters of steam distillate usually had a strong smell. The intensity of the odor depended on the quality of the water treated. In blank experiments distilled water was treated in the same way. The steam distillate was completely inodorous in these experiments. It was also possible to concentrate the odoriferrous compounds by vacuum treatment of the oil bearing precipitates, using a liquid air trap as receiver.

Some illustrative results are given in Table 1:

Table 1

Purification of River Water by Treatment in Batch with $FeCl_3$ and Sesame Oil

liters of water purified	Oil added (mg/L)	$FeCl_3$ added (mg/L) of Fe^{+++}	Treatment of the Precipitate	Odor of volatile products obtained from precipitate
3	0	12	steam dist.	inodorous
3	20	12	steam dist.	strong odor
3	0	12	steam dist.	inodorous
3	20	12	steam dist.	strong odor
5	0	12	vacuum treatment	inodorous
5	20	12	vacuum treatment	strong odor
5	0	12	vacuum treatment	inodorous
5	20	12	vacuum treatment	strong odor

Continuous Purification

In a second series of investigations, water was taken from the Schie canal upstream from the city of Delft. Samples were taken at a level 4 to 5 inches below the canal surface to reduce the oil and sludge content of the water to a minimum. The water was purified in a continuous process. A flow sheet of this continuous process is shown in Fig. 1. Fresh samples of raw water were taken once a day and stored in the storage tank. From this tank the water was pumped upwards to the feed tank, from where it flowed down to the flocculation apparatus.

Table 2

Purification of water by treament with $FeCl_3$ (12 mg/L of Fe^{+++}) Odor of distillates obtained by vacuum treatment of floc.

Amount of water treated at moment of floc sampling (liters)	Vacuum during vacuum treatment (mm.Hg)	Odor of distillate (code number)
225	30	1
587	18	0
745	18	2
1145	17	4
1432	17	4
1475	13	2
1560	15	2
1652	15	2
1805	45	4
2053	85	4
2136	50	1
2225	85	4
2315	60	4
2405	120	4
2495	65	4
2585	60	3
2685	35	3

This apparatus is a slightly modified version of a model developed by Dr. T. Folpmers. The apparatus is shown in Fig. 2. It consists of a mixing zone, in which oil-emulsion, $FeCl_3$ and water are intimately mixed by mechanical agitation; a flocculation zone in which the floc is formed; and a blanket zone, in which the floc is separated by a floc blanket and deposited in the floc settling funnel. The apparatus is built on the same principles as the well known Spaulding precipitator. The distinguishing feature, however, is a slit of adjustable width that separates the flocculation zone from the blanket zone. By adjusting the slit to a suitable width the floc blanket can be made to revolve slowly inside the blanket zone. In this way a better contact between water and floc is obtained and shortcircuiting is much reduced. A perforated baffle plate separates the mixing zone from the flocculation zone.

Raw water was fed to the apparatus at a rate of 60 L/hr. $FeCl_3$ was added as a 1.8 per cent solution in distilled water. Refined sesame oil, redeodorized before use by treatment with steam and activated carbon, was added as a 1 per cent emulsion in distilled water. The emulsion was continuously stirred at high speed to prevent it from creaming or coagulating.

Two experiments were carried out. In the first one, the raw water was treated with $FeCl_3$ (12 mg/L of Fe^{+++}) only. In the second experiment $FeCl_3$ (12mg/L of Fe^{+++}) and sesame oil (20 mg/L) were added.

The amount of oxygen absorbed from permanganate was reduced to about half the original value by coagulation of ferric hydroxide. The addition of sesame oil had no marked influence on the reduction by the coagulation of the amount of oxygen absorbed from permanganate.

Floc samples were taken from the floc settling funnel. The flocs obtained in both experiments were washed once with distilled water and subjected to vacuum treatment. The distillates were again collected in liquid air traps. The odors of the distillates were judged according to the following scale:

0 = inodorous
1 = very faint, disagreeable odor
2 = faint, disagreeable odor
3 = distinct, disagreeable odor
4 = marked, disagreeable odor
5 = strong, disagreeable odor
6 = very strong, disagreeable odor

The numbers have no numerical significance but serve as a code only.

The results of the experiments, in which the raw water was treated with $FeCl_3$ are shown in Table 2. The results of the experiments in which $FeCl_3$ and sesame oil were added to the raw water are shown in Table 3.

It is evident that the distillates obtained by vacuum treatment of the oil-bearing flocs have a stronger odor than those obtained by vacuum treatment of the flocs that contained no oil.

Table 3

Purification of water by treament with $FeCl_3$ (12 mg/L of Fe^{+++}) and refined sesame oil (20 mg/L). Odor of distallates obtained by vacuum treatment of floc.

Amount of water treated at moment of floc sampling (liters)	Vacuum during vacuum treatment (mm.Hg)	Odor of distillate (code number)
327	65	3
604	50	4
875	46	4
1022	50	4
1228	60	5
1420	60	5
1490	40	5
1605	40	4
1810	60	5
1898	48	5
1965	80	5
2155	30	5
2327	55	6
2597	60	6
2690	60	5
2940	40	5

Conclusions

1. Certain compounds, that affect the taste and odor of surface waters, are removed from these waters by treatment with small amounts of a fatty oil. The taste and odor of the waters are improved.[2]
2. The oil used may be removed from the water by flocculation of ferric hydroxide.
3. Strongly smelling compounds are obtained from the oil-bearing floc by steam distillation of vacuum treatment.

Acknowledgments

Our thanks are due to H. J. Lovink and A. Brakel for carrying out the preliminary experiments and to M. A. Kievit, who participated in the continuous purification experiments. We are indebted to Dr. T. Folpmers for his kind permission to publish the flocculation apparatus.

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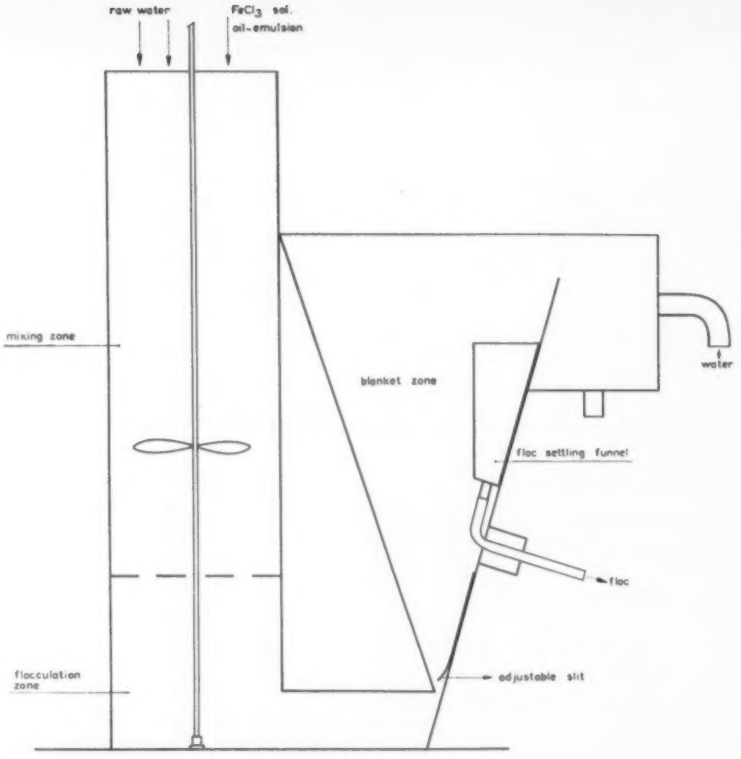


FIG. 2—FLOCCULATION APPARATUS.

Waste Water Reclamation and Utilization

The California State Water Pollution Control Board, Sacramento, Calif., has released the Third Report on a "Study of Waste Water Reclamation and Utilization."

This third and final report, on the subject of the reclamation and utilization of waste waters is the cumulative result of an investigation that began in July 1954. The first year's study, "A Survey of Direct Utilization of Waste Waters," was issued as Publication No. 12 of the California State Water Pollution Control Board.

This final report documents the results of a second year of study of the principal investigations begun in 1955 at San Diego and Mojave, as well as studies initiated within the past year at the United States Marine Corps Base at Twentynine Palms and the United States Naval Ordnance Test Station at China Lake. A major undertaking the field of agricultural utilization of waste waters in the Talbert Valley of Orange County is also recounted.

Therefore, the conclusions presented in Chapter I of this final report are based not only on the information in the curent report but also on the work performed and reported on during prior years.

Chapter II, "Continuation of a Survey of the Direct Utilization of Waste Waters," covers: 1.) The Industrial use of Waste Water; 2.) The Agricultural Use of Waste Water; 3.) The Recreational Use of Waste Water; 4.) Recharge; and 5.) Pertinent Abstracts.

Chapter III, on the "Reclamation of Liquid Sludge in San Diego County, Calif., discusses and illustrates the Tijuana and Mission Bay Park Test Programs and a section on Replicated Plots.

Chapter IV, reports on the Mojave Test Program, which was an "Investigation of the Primary Lagoon as a Means of Waste Water Reclamation."

Chapter V, is a report on the special studies made at the U. S. Marine Corps Base at Twentynine Palms and the Air-Borne Bacterial Study.

Single reference copies of this report are being furnished without charge to governmental officials and agencies directly concerned with water pollution control and related fields, to educational institutions and libraries, and to individuals and organizations that participated in the research projects. Additional copies may be purchased from the State Printing Division, Documents Section, Sacramento 14, California, at a cost of $1.40 per copy. This cost includes postage but not the $0.06 sales tax which must be added for California addresses. Remittance must accompany order.

* * *

Wow! I've just 'gotta' buy something to destroy these odor causing bacteria of mine.

As many large communities have found out, a small town discovered its water shortages were not caused by supply or the system itself. Castine, Maine found that . . .

Meters Solve a Water Crisis

by MRS. LILLIAN M. OWEN, President and Treasurer, Castine Water Company, Castine, Maine

■ AS MANY CITIES AND TOWNS have discovered recently, water systems built many years ago have begun to show the signs of increasing population and per capita consumption. The result is that chronic water shortages crop up in periods of especially dry weather.

Castine, Maine, a small town located on a peninsula between the Penobscot and Bagaduce Rivers south of Bangor, is no exception. The first warning came in the very dry summer of 1952. As early as July of that year, it was noted that reservoirs were not maintaining proper levels. Wells and springs which form most of our supply were not yielding enough water to keep up with demands.

Water Barge Used

The low point came in October, when a Navy barge was used to ship water into Castine town for a short time. It was necessary to call on the barge again in December, just before heavy rainfall put the system back on a normal basis.

The barge hauled water first from Bar Harbor, and later from Bucksport, because too much time was consumed in the trip from Bar Harbor.

Water from the barge was pumped into the mains, and then into the State Street reservoir.

Finally, during the latter part of December, heavy rains fell, and the system was able to resume business as usual.

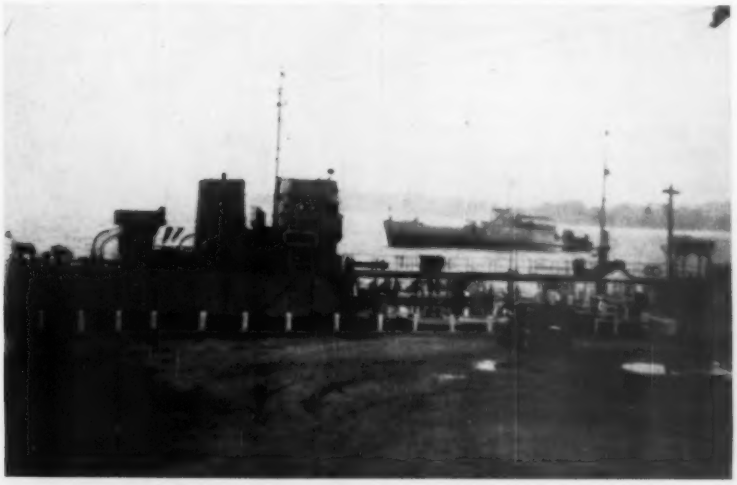
System Leakage Not Cause of Shortage

Naturally, with the shortage, people began to talk about big leaks in the system. However, a careful check of mains and reservoirs failed to find any significant leakage. Also, the entire pipe line system was thoroughly checked with detecting instruments. When it was suggested that one reservoir might be leaking, the reservoir was shut off, and remained at a constant level for about a week. This meant that water could safely be stored here.

Again in 1953, although the reservoirs were full to overflowing, in June, there was another period of shortage in October. Competent engineers who were called in to look over the system were puzzled about where the water was going. Even though the system was unmetered, the indicated per capita consumption was considerably higher than what might be expected.

After this experience, it was decided to take a close look at the water supply and distribution system, to make sure that there wouldn't be another period of danger as serious as the one just experienced. It became evident that drastic measures were needed, if the water company were to survive.

On December 7, 1953, Mr. Leslie Little, consulting engineer of Bucksport, filed for a 75% increase in rates,



NAVY BARGE unloading water at Castine to relieve shortage.

which became effective in May, 1954. The Maine Public Utilities Commission suggested that the system be completely metered and that a larger main be installed from the Station 4 pumping station to connect into the low pressure system. These lines were installed and began service on July 15th, 1954. With these facilities, any excess water over current use could be pumped into reservoirs at Battle Avenue and State Street. A new centrifugal pump was added for more efficient operation.

Corrects Shortages

As for metering, in the Spring of 1954 the company was authorized to re-issue $5000 in 4% First Mortgage refunding bonds. Before this became effective, there was purchased, through a personal loan, $1000.00 worth of meters, which were installed in July, 1954.

The Maine Maritime Academy and larger commercial customers were previously metered. The metering program has been continued through each year to date. There are now approximately 200 meters installed, representing approximately ¼ of the total number of customers.

Since metering has been in operation, the reduction of consumption and reduction of waste have resulted in more storage reserve, and thus far has eliminated the need for developing new sources of supply. Since the installation of meters, there have been periods as dry as the bad spell of 1952 but so far no actual shortage has occurred.

There was no provision for measuring per capita consumption before metering, because sources of supply are interconnected to some extent by gravity flow and pumping. For example, a large source of supply is made up of five ponds fed by ground water, from which large amounts of water are fed directly into the system without metering. Water is transferred between storage supplied by gravity and by pumping through the distribution system pipe lines.

However, tests made during the two dry periods . . . in 1952 and 1953 . . . indicated an average per capita consumption, for residential and small commercial customers, of approximately 500 gallons per day.

From readings taken on meters during 1957, the average billed consumption for residential and small commercial users had dropped to about 150 gallons per day.

Insurance Rates Lowered

Another important benefit received from the use of meters was in the fire insurance rates.

In the fall of 1952, insurance underwriters transferred Castine from a Group D town at $0.37 per year per $100, to Group E (unprotected group), at $0.60 per year per $100.

As the water in storage increase produced by metering careful readings were made of the amounts of water in the reservoirs, and, with the help of a raingage, the amount of rainfall was measured. Weekly readings of these reports were sent to the New England Fire Insurance Rating Ass'n.

The Group D rating was restored in March 1956, and, with a lower rate throughout the state, the rate was cut to $0.31 per $100.

As result of a water crisis, and four years hard work, Castine now enjoys improved pumping facilities, more direct water mains, has a good start on complete metering, and many more small but essential improvements.

Supply Sources

Castine Water Works

Castine lies on a peninsula between two rivers — the Penobscot and Bagaduce — with no available body of surface water near enough to be practical as a source of supply. As a result, wells and springs are used as the main supply.

There are five supply stations:

1. *Witherlie Park.* High pressure reservoir, with elevation of 216 feet. This is a rectangular masonry structure with covered roof, which holds about 400,000 gallons. A small 200-gpm pump takes water from a 675-ft well, and, by constant pumping, takes all the water this well can supply.

2. *Battle Avenue.* System of five storage basins at varying altitudes, which collect water from a wooded area above. Basins average about 250 ft square, 12 ft deep. This group holds about 9,000,000 gallons of water. A 100 gpm pump is installed in the basement of a two-story building at this station. On the main floor there is a gasoline Chrysler Industrial pump capable of providing 500 gal a minute.

3. *State Street.* Circular masonry reservoir with 450,000-gallon storage capacity. In normal operation, water is fed into the low pressure system through a 6-in. line with valve partly open. Water can also be fed by gravity into the lower level ponds on Battle Avenue, or it can be fed by gravity from the higher level pond at Battle Avenue to the reservoir at State Street. A 5-hp electric pump draws water from an 8-in. drilled well about 70 ft deep. Constant pumping is at an average rate of 18 gpm.

4. *Spring Street.* Three brick and stone reservoirs, roofed over, with storage capacity of 330,000 gallons. Source of supply is ground water from springs, collected in clay basins. A 100-gpm centrifugal pump was installed in June 1954. This is our largest source of water.

5. *Dutch Oven.* Summer operation through surface pipes. Water is collected from small springs into a small reservoir, and pumped when the reservoir is filled, into the State Street reservoir. Electric pumping is automatic, and runs between 3000 and 6000 gallons per day.

Monday it was black top soil, Tuesday red clay, and today, gray clay! Next I suppose you'll hit oil and I'll never get the ring off my tub!

WATER WORKS PRACTICES

Water Softening

Part 3—Cation Exchange

The forty-fourth of a series
by GEORGE E. SYMONS,
Consultant & Technical
Editor, Larchmont, N. Y.

EDITOR'S NOTE: After a lapse of more than a year, it has become possible to resume the presentation of these short school-type lectures, designed to assist operators, students and others who may wish to review the fundamentals of water works practices. The forty-third installment in the series appeared in November 1957 and was devoted to "Water Softening—Part 2; The Lime-Soda Process. Unfortunately, space available in that issue did not permit the inclusion of subsections 5e and 5f, on sludge concentration and sludge disposal. These two subsections appear at the end of this installment. Future installments will be devoted to demineralization, iron and manganese removal, miscellaneous treatments, laboratory control, plant control, maintenance, and management.

D . . . Ion Exchange

1 . . DEFINITIONS

a. *Zeolite*: From the Greek words *zein*, to boil, and *lithos*, stone, a family of hydrous silicates occurring in the cavities of lavas.

(1) The term has been loosely applied to any substance having the property of giving up its cation content in exchange for the cations in a solution surrounding or passing over it.

(2) In 1949, the AWWA Committee on "Specifications for and Methods of Testing Cation-Exchangers" indicated that "there is no scientific justification for using the term 'zeolite' to designate any of the cation-exchange materials in use today".

. . . The committee report continued, "although there has been no serious objection to extending the use of the word 'zeolite' from the mineralogical field, to the field of water treatment because of the similarity between the cation-exchange reactions of these minerals in nature to the reactions of the cation exchangers in water treatment processes, the increasing deviation of the composition of cation-exchangers from the zeolite minerals makes it desirable to use the more precise term 'cation exchanger' ".

b. *Cation exchanger*: A substance having the property of giving up its content of cations (positively charged ions) in exchange for those present in a liquid surrounding or passing over it.

c. *Anion exchanger*: A substance having the property of giving up its contents of anions (negatively charged ions) in exchange for those present in a liquid surrounding or passing over it.

d. *Base exchanger*: Another term for cation exchanger.

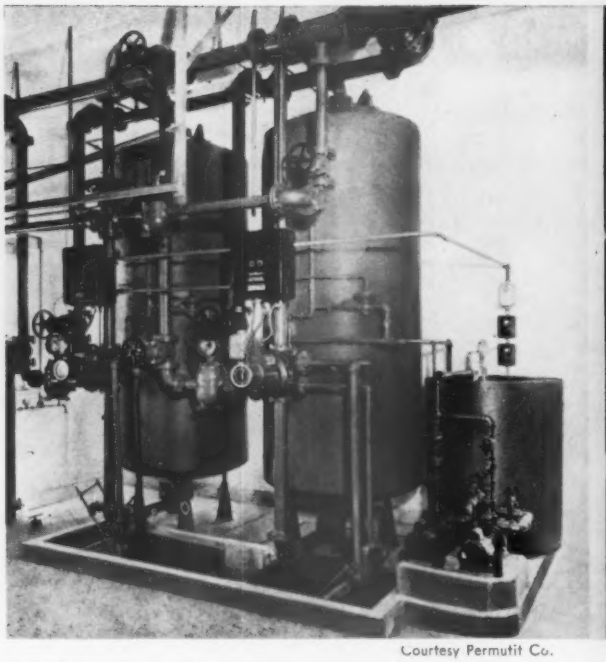
e. *Exchange capacity*: The amount of cations or anions an ion-exchange substance will take up or remove from a liquid, expressed in terms of quantities of the unwanted substances removed per cubic foot of the ion-exchange material.

(1) In the case of cation exchangers, this value is expressed in terms of calcium carbonate equivalent, as grains removed per cubic foot, or as kilograins (1000 grains)—a kilograin being equivalent to 64,800 mg.

(2) Anion exchangers are also rated in terms of calcium carbonate equivalent.

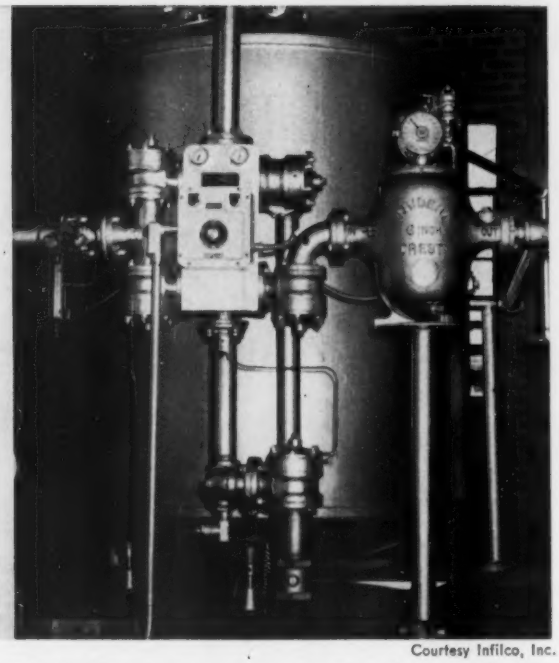
f. *Reversibility*: The property of ion-exchange material which makes it possible to replace certain ions in the exchange material with others depending on the concentration of the respective ions in the liquid and the exchange substance.

For example, when all of the sodium ions in a cation exchange material have been replaced by calcium



Courtesy Permutit Co.

DOUBLE UNIT cation-exchange water softener with automatic valve operation.



Courtesy Infilco, Inc.

SINGLE UNIT cation-exchange water softener with automatic valve operation.

or magnesium from hard water, the calcium and magnesium can then be driven out and replaced by sodium contained in a strong solution of salt.

g. *Regeneration*: The process employing the principle of reversibility whereby, when the exchange capacity of a substance has been exhausted by use, that capacity can be regained (regenerated) by treatment of the material with a strong solution of the ions desired to be introduced into the substance.

h. *Permutit*: A term applied in the early years of ion-exchange softening to "zeolites" which contain silicates and alkalies combined principally with alumina and which substitute their bases nearly completely in a short time. The term is no longer used and exists only as the name of a company which pioneered water softening by this method.

i. *Zero hardness*: The hardness resulting from cation-exchange softening is so low that a soap test will not indicate any hardness. For all practical purposes, the water has "zero hardness". In practice, a properly operated cation-exchange softener, treating a normal water free from excessive amounts of sodium salts, will deliver, for most of the softening run, a water free of calcium and magnesium.

j. *Demineralization*: A process whereby both cations and anions are removed from water by passing it through cation- and anion-exchangers.

2 . . History

a. According to Nordell, the property of natural sodium-alumina-silicates to exchange basic ions was first observed in 1845 by an English farmer, H. S. Thompson.

(1) Thompson, "speculating on why fertilizers were not washed out of the soil by the first heavy rains following their application, made a filter of common garden soil and poured through a solution of manure".—The soil completely removed the ammonia from the solution.

. . . Thompson called in a chemist, Spence, who found that while ammonium had been removed, an equivalent amount of calcium had been put into the solution.

. . . It was three years later before Thompson related the incident to J. Thomas Way, chemist to the Royal Agricultural Society of England.

(2) Way made extensive experiments and reported his observations in 1850 and 1852; he believed the base-exchange properties were due to zeolites, which term had been given in 1756 by a Swedish geologist, Cronstedt, to a class of minerals (silicates) which give up water or hydration when strongly heated.

(3) Way discovered that these soils were silicates and that only hydrated silicates had this property, and he synthesized silicates having this property, from sodium silicate and sodium aluminate, but he believed the exchange property to be irreversible.

b. The reversibility of the ion exchange reaction was first reported by the German chemist Eichorn in 1858.

c. Application of the ion-exchange process to water treatment came in 1906, when Gans and co-workers obtained a German patent for water softening by base exchange.

(1) The material used was made by fusion of raw materials.

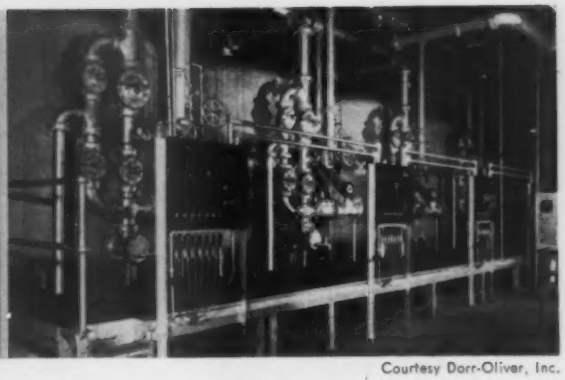
(2) Reaction rates were slow, requiring from 8 to 12 hours for both softening and regeneration.

d. Bentonite clay discovered in the United States some years later, when suitably processed, had good overall base exchange properties but was slow both in softening and regeneration.

e. In 1920, glauconite (greensand) was patented after its discovery in New Jersey. It had a high rate of exchange and short regeneration period.

Courtesy Infilco, Inc.

GRAVITY ion-exchange softener with Robotrol® controllers at Greendale, Wis.



Courtesy Dorr-Oliver, Inc.

FOUR nine ft dia. ion-exchange cells operating in parallel to soften water for industrial plant.

f. In the 1920's, synthetic cation-exchanger material was successfully produced as a gelatinous precipitate, and later the "gel" type exchange material was produced without precipitation. Both types were dried and crushed to the desired particle size.

g. In the late 1930's, non-siliceous exchange material was first produced by sulfonating carbonaceous material, such as coal, wood and tan bark. One commercial product is termed "Zeo-Karb".

h. Last in the development were the synthetic exchange materials, such as sulfonated phenol-formaldehyde resins and polymethyl acrylic acid, etc.

3 . . Mechanism of Ion Exchange

a. The modern concept of crystal lattice structure of compounds of this nature furnishes the basis for the mechanism by which calcium or magnesium in water may be exchanged for sodium in the ion-exchange material and vice-versa.

b. The softening action or removal of calcium and magnesium as well as regeneration of the material depends on the principle of mass action.

4 . . Cation-Exchangers—Sodium Cycle

a. The most common cation-exchange materials used in municipal water softening, operate on the sodium cycle.

(1) These compounds exchange sodium for calcium and magnesium and salt is used for regeneration.

(2) These compounds include glauconite (greensand), precipitated synthetic sodium-alimina-silicates, fused synthetics (no longer used), non-siliceous carbonaceous materials and resins.

b. The specific gravity and weight per cubic foot varies depending on the particular substance. The following table gives some approximate weights.

Material	Lb/cu ft
Natural material (with 10% H_2O)	100
Synthetic silicates (with 50% H_2O)	55 to 70
Carbonaceous	24 to 30
Polystyrene resins	53
Strongly basic resins	43 to 45
Weakly basic resins	17

c. The exchange capacity and regeneration requirements are as shown in Table 3.*

Table 3

Exchange Capacity and Regeneration Requirements

Material	Exchange Capacity Kilograins/cu ft as Ca CO_3	Regeneration Requirements lb salt/ Kilograin exchanged	
		Actual	Theoretical
Glauconite	3 to 6	0.5 to 1.0	0.167
Synthetic Silicate	6 to 16	0.4 to 0.5	0.167
Carbonaceous and resin	5 to 40	0.3 to 0.6	0.167
Carbonaceous and resin (H_2 Cycle)	5 to 40	0.3 to 0.6*	0.137
Anion exchange resins	12 to 25	0.6 to 1.0**	0.120

*Regenerant is H_2SO_4

**Regenerant is NaOH

*Table 1 appeared on p. 399, Sept. 1957; Table 2 on p. 497, Nov. 1957

d. The reactions involved in sodium cycle exchangers are shown in the following equations where "R" represents the exchange material of whatever type used.

(1) Softening Reactions.

$$Ca(HCO_3)_2 + Na_2R \rightarrow CaR + 2NaHCO_3$$
$$CaSO_4 + Na_2R \rightarrow CaR + Na_2SO_4$$
$$CaCl_2 + Na_2R \rightarrow CaR + 2NaCl$$
$$Mg(HCO_3) + Na_2R \rightarrow MgR + 2NaHCO_3$$
$$Mg(SO_4)_2 + Na_2R \rightarrow MgR + Na_2SO_4$$
$$MgCl_2 + Na_2R \rightarrow MgR + 2NaCl$$

(2) Regeneration Reaction.

$$CaR + 2NaCl \rightarrow CaCl_2 + Na_2R$$
$$MgR + 2NaCl \rightarrow MgCl_2 + Na_2R$$

(3) Other reactions.

. . . If sodium bicarbonate is present, to any degree it may tend to produce regeneration coincident with softening, thus exerting a "back-pressure" which prevents the complete softening of the water.

. . . These ion exchange materials will also remove ferrous iron, but if dissolved oxygen is present, ferric hydroxide will be formed and will coat the grains, reduce their softening capacity, and plug the bed.

(4) Inasmuch as two ions of sodium enter the water in exchange for each ion of calcium or magnesium removed, the total weight of dissolved solids in the effluent is more than it is in the hard water.

. . . The increase is in the ratio of 106 to 100, based on the total hardness removed as calcium carbonate. This fact has an important bearing on the use of ion-exchange softening for boiler water treatment.

Courtesy Graver Water Cond. Co.

CATION-EXCHANGE water softeners at Newbern, Ind.

5 . . Cation Exchangers—Hydrogen Cycle

a. Certain types of cation exchangers will remove not only calcium and magnesium but also sodium and potassium.

(1) These substances exchange hydrogen for the alkaline metals and operate on the hydrogen cycle; regeneration usually is by sulfuric acid.

(2) Hydrogen cycle cation-exchanger materials include: Sulfonated coal, phenolic methylene sulfonics, nuclear sulfonics and carboxylic resins.

b. These materials are, fundamentally, an insoluble acid, with a sturdy cross linked structure resistant to attrition and are generally insoluble over pH range of 1 to 8.

c. The exchange capacity for hardness removal and the regenerative requirements of these materials are the same as when operating on the sodium cycle, although the theoretical amount of acid required is less than the theoretical requirement of salt.

d. Reactions involved in cation exchangers operating on the hydrogen cycle are:

(1) Softening Reaction.

$$Ca(HCO_3)_2 + H_2R \rightarrow CaR + H_2CO_3$$
$$CaSO_4 + H_2R \rightarrow CaR + H_2SO_4$$
$$CaCl_2 + H_2R \rightarrow CaR + 2HCl$$
$$Mg(HCO_3)_2 + H_2R \rightarrow MgR + H_2CO_3$$
$$MgSO_4 + H_2R \rightarrow MgR + H_2SO_4$$
$$MgCl_2 + H_2R \rightarrow MgR + 2HCl$$
$$2NaHCO_3 + H_2R \rightarrow Na_2R + 2H_2CO_3$$
$$2KHCO_3 + H_2R \rightarrow K_2R + 2H_2CO_3$$

(2) Regeneration reaction.

$$CaR + 2\,HCl \rightarrow H_2R + CaCl_2$$
$$MgR + 2\,HCl \rightarrow H_2R + MgCl_2$$
$$Na_2R + 2\,HCl \rightarrow H_2R + 2\,NaCl$$

(3) In waters containing high sodium and sulfate or chloride concentration, a phenomenon termed "elution" or "sodium slippage" occurs near the end of a run of hydrogen cycle softening, and some of the sodium previously removed from the water is displaced from the resin by calcium and magnesium.

(4) When sulfates, chlorides and nitrates are present in the raw water, these are converted to the respective acids during the softening reaction, with a concomitant lowering of pH. This problem is discussed later under the section on operation.

(5) Inasmuch as the weight of the acids produced is less than that of the equivalent weight of the dissolved hardness, the total dissolved solids content of the water is reduced in the softening process.

. . . Furthermore, the carbonic acid produced from the bicarbonates breaks down to carbon dioxide and water; this carbon dioxide can be removed by a simple degasification system, thus greatly reducing the total solids content.

6 . . Application

a. The cation-exchanger softener is the mostly widely used in the United States, particularly in municipalities and homes, as well as to a large extent in industry. More than 300 municipalities now employ ion-exchange softening (about half the number employing line softening).

b. In both industry and home softening, water of zero hardness is produced, but in municipalities, operation is such as to produce a water having a hardness of 70 to 85 mg/L. (See section on Operation)

c. Fluctuations in hardness of the raw water are automatically taken care of by cation-exchangers, the only effect being on the volume of water softened between regenerations.

d. As indicated heretofore, cation-exchange softening is not desirable where the character and amount of sodium salts produced is objectionable. (See discussion on Operation)

e. Cation-exchange softening is generally uneconomical in waters having a hardness of more than 850-1000 mg/L, except perhaps in industry.

f. Hydrogen cycle softening has not been applied in municipal softening installations, but may find future application in this field.

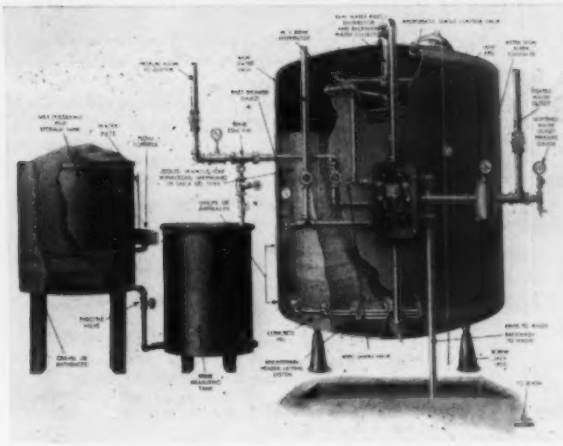
7 . . Equipment

a. Cation-exchange softeners consist essentially of a container for a layer (bed) of exchange material and a means of passing water, brine, wash water, or rinse water through the bed, as desired.

(1) The container may be open for gravity feed or closed for pressure operation.

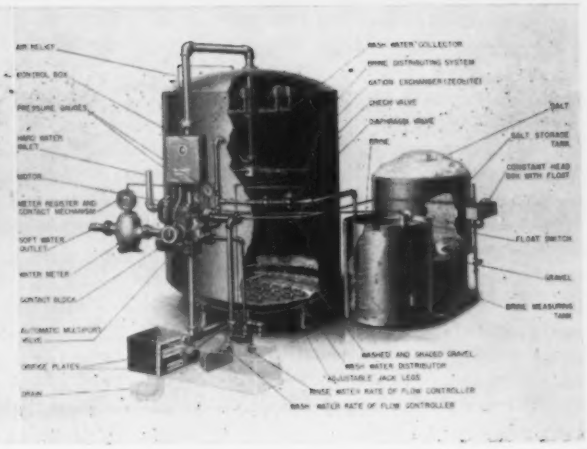
. . . Pressure exchangers can be operated at higher rates of flow than gravity systems, but operation can not be observed.

(2) Flow through the exchanger



Courtesy Cochrane Corp.

CUT-AWAY view of Cochrane ion-exchange unit for operating on sodium cycle.



Courtesy Permutit Co.

CUT-AWAY view of Permutit ion-exchange unit for operating on sodium cycle.

may be downward at any rate, or upward, but the rate of upward flow must be constant and cannot be high enough to expand the bed too much, or to wash the grains out of the tank.

b. Design of cation-exchangers must take into account: proper distribution of water, backwash, brine, and rinse water through the bed; permissible rates of flow; salt consumption; volume of wash water and rinse water required; and capacity of exchanger in terms of volume of water treated between regenerations.

c. Appurtenances

(1) Where the sodium cycle is used, the most useful appurtenance is a brine saturator for making up the regenerating solution.

. . . Concrete wet-salt storage basins, holding one or more carloads of salt, are widely used in municipal installations. Constant level of water is maintained in the storage to provide a large supply of saturated brine; this brine is pumped to brine measuring tanks from which it goes to the softener for the regeneration reaction.

. . . Where the acid cycle is used, storage for the acid must be provided.

(2) Valves are necessary to control the flow of raw water, backwash water, brine, and rinse water.

. . . In older installations (and home installations) manual control of operations is used; multiport valves have simplified the operation.

. . . In newer equipment, automatic operation is possible, with automatically operated, multiport valves plus meters and timers to control the flow of raw water, backwash water, and brining and rinsing operations.

d. Multiple Units

(1) In some installations, it may be found advantageous to have more than one unit, particularly if storage facilities for softened water are not large. Multiple units permit continuous operation, and provide standby equipment in case of required maintenance.

(2) Where water of controlled alkalinity and low total solids is required, two units, one operating on the sodium cycle and one on the hydrogen cycle, may be used.

e. Other Appurtenances

(1) For municipal use, where zero hardness is not desired, and the final product is obtained by mixing raw and softened water, a proportioning device to control the mixture is a necessary part of the installation.

(2) Auxiliary hydraulic surge eliminators are often used where water is pumped through an automatic cation-exchanger to an elevated storage tank.

(3) Testing equipment is also necessary to check on operation of the softeners.

8 . . Operation

a. Downflow ion-exchanger softeners (both pressure and gravity) operate on a four-step cycle: Softening, backwashing, brining, rinsing. Upflow softeners omit the backwashing step.

b. Softening rates of flow depend on whether or not the device is a gravity or pressure softener and whether or not it is an upflow or downflow softener.

(1) The length of the softening run depends on the exchange capacity of the ion-exchange material and the amount of ion-exchange material as well as the amount of hardness to be removed from the water.

(2) If the hardness of the raw water is constant, the softening cycle can be discontinued, when the bed is exhausted, by a metering control device which will automatically shut off the flow of raw water and initiate the regeneration steps.

c. *Backwashing* is accomplished by passing a relatively strong current of water upward through the softening bed. The purpose is to loosen and regrade the particles of exchange material, and to wash out any dirt which may have accumulated on the bed during the softening run. (Backwashing is not used in upflow softeners)

d. *Brining* is accomplished by introducing a predetermined amount of solution of common salt (for softeners operating on the sodium cycle). A hydraulic ejector is used to add the brine to the softener.

(1) As the salt brine passes through the bed, it reacts with the ion-exchange material, driving out the calcium and magnesium and regenerating the ion-exchange material. This step requires only a few minutes.

(2) The amount of salt required

for regeneration theoretically is only 0.167 lb to replace the calcium and magnesium removed for each 1000 grains of hardness as calcium carbonate.

. . . In practice it requires approximately 0.35 lb of salt for regeneration for each 1000 grains of hardness removed. One reason is the reversibility of the reaction and the need to have an excess of salt to drive the reaction in the direction desired; another reason is that greater overall efficiency is obtained when the amount of salt used for regeneration is 0.35 lb per 1000 grains of hardness removed.

. . . Lower salt regeneration quantities reduce the softening capacity of the exchanger.

(3) In the case of exchangers operating on the hydrogen cycle, dilute sulfuric acid (instead of salt solution) is used in the "brining" step.

. . . The amount of acid used is approximately the same as salt requirements, although the theoretical acid requirement is less than the theoretical salt requirement (see Table 3).

e. *Rinsing* is accomplished by passing treated or raw water through the bed at a relatively low rate of flow. Rinsing removes the calcium and magnesium chlorides (or sulfates and chlorides in the hydrogen cycle softener) as well as the excess brine (or acid as the case may be).

f. The total time required for the three steps involved in regeneration is from 30 to 40 minutes.

(1) If sufficient treated water is available to allow for this downtime, only one softening unit is required in an installation; otherwise two or more units are necessary.

(2) In automatic units, the necessary valve openings and closings during regeneration are accomplished by a timing device control system and motor driven multi-port valves.

9 . . CONTROL

a. Chemical control of the ion-exchange process is simple; all that is required is a simple hardness test (versenate or soap test), which can be used to determine both the exhaustion of the bed and the rinsing out of the salt brine. In automatic softeners, the control test is merely a check on the cyclic operations.

b. Corrosion may occur in waters completely softened (zero hardness) unless it is guarded against.

(1) Zero-hardness water is not corrosive in itself, but the absence of calcium and magnesium compounds prevents the formation of any alkaline coating on the metal which will protect it against corrosion.

(2) The usual method of preventing corrosion is to mix a definite amount of unsoftened raw water with the softened effluent, so that the mixed water has a pH and alkalinity that will produce the desirable saturation with respect to calcium carbonate.

. . . In municipal practice, waters having a hardness of from 70 to 100 mg/L are considered satisfactory. Therefore it is not difficult to maintain the desired calcium bicarbonate content.

(3) Turbid waters should not be applied to cation-exchangers without previous clarification.

(4) In the case of softeners operating on the hydrogen cycle, the low pH of the softened water will contribute to the corrosive character of the effluent from the softener.

. . . The pH can be raised to normal limits by the addition of sodium hydroxide, or by mixing unsoftened water with the softened effluent to produce a water of the desired pH and a hardness below 100 mg/L.

. . . Another method of controlling pH is to mix the effluent of a sodium cycle exchanger with that of a hydrogen cycle exchanger. By the proper combination it is possible to produce a water of zero hardness, lowered mineral content, yet with the desired pH and alkalinity.

c. Combination Treatment

(1) Sometimes, it is more economical to employ a combination of lime softening followed by cation-exchange.

(2) The water is first treated with sufficient lime to reduce the carbonate hardness to the desired level.

. . . The lime softened water is coagulated and settled to remove the precipitates and then recarbonated to prevent precipitation of calcium carbonate on the ion-exchange grains. (The pH of the water is reduced below 9.5 to prevent damage to the cation-exchange material.) After recarbonation the water is filtered.

Addendum to Water Softening Part 2—Lime-Soda Process*

e. Sludge Concentration.

(1) In the solids contact clarifiers the concentration of solids in the sludge blanket or slurry is important as is the level of the sludge in its zone. Sludge levels may be checked at intervals by the operator or by automatic devices.

(2) Concentration of the sludge solids may be controlled to 0.5 to 2.0 per cent by weight and determined at regular intervals.

. . . Visual determination of the per cent volume of sludge produced in 5 or 10 minutes of quiescent settling in a graduate may be empirically related to the solids concentration by weight as well as to the sludge level in the clarifier.

f. Sludge disposal.

(1) The amount of sludge produced is always greater than the amount of chemicals added.

(2) As indicated, heretofore, some part of this sludge may be recycled in the process to provide nuclei for precipitation, but once this cycle is established, there remains a continuous production of sludge to be disposed of.

(3) This sludge may be discharged to a stream, where it is a pollutant, or it may be lagooned or filtered on a vacuum filter.

. . . The vacuum filtered cake may be calcined and recovered as lime, or dumped on unused land or used for farm soil treatment.

*See Nov. 1957, p. 496

(3) The lime-softened and filtered water is passed through a cation-exchanger to reduce the non-carbonate hardness.

. . . By proper control of the lime softening and proportionate mixing of lime softened and exchanger softened water the final desired product can be obtained.

"OUR HEALTH Department orders us to chlorinate all our water now."

MANAGEMENT SYMPOSIUM

Water Works Management—Part III

EDITOR'S NOTE: At the 62nd annual meeting of the Penna. Water Works Assn., these were nine papers presented on various aspects of water works management. The program had been arranged by John Murdock, Jr. president of the association. WATER & SEWAGE WORKS is fortunate to obtain permission to publish slightly condensed versions of the nine papers as a three part symposium on Water Works Management. Three papers appear in this section.

Use of Physical and Operational Data

by WENDELL R. LaDUE, Supt. and Chief Engr., Bureau of Water Supply, Akron, Ohio

■ A WATER WORKS manager's primary responsibility is two-fold. First he must assure an adequate outflow of potable water from the faucets for all consumer uses and, second, he must receive an adequate inflow of funds for the utility's needs. All else is secondary.

In the exercise of the functioning of this responsibility the manager must depend largely on studies and analysis by engineers and accountants. For the continuous orderly and efficient operation of the utility, coordinations of management, engineering, and accounting are admittedly necessary.

Let us review briefly the various phases of the manager's problem in exercising this primary responsibility. Consider, as a primary function, the problem of supplying water to the consumer to satisfy his many demands and needs.

Planning

The manager must have a clear understanding and often advance knowledge of every changing national and local trend as they involve coordinated use of water resources through changing and shifting populations and varying industrial distribution factors. This knowledge is essential in determining a timely and directed expansion program, tailored not only to meet adequately, but to anticipate the increased demand for water.

Operation and Maintenance

The efficient day by day operation and maintenance of the system is of primary concern to the manager. He must be aware of the ever moving changes so inherent to a water utility's activities.

Expansion

The manager's planned expansion schedule is subject to constant review and change due to policy change, often beyond his control, expanding and shifting distribution patterns for demand of water, and the new economic and living patterns of the consumer. To cite the latter we have a presently developing and indicated trend of a return from "Suburbia" to the City. A shift of this type often throws difficult problems in the lap of the Manager.

Personnel

In Personnel we have the most important unit of the utility system. Not only is it important in itself that it be progressively up-to-date, but it must be regarded as one of the most sensitive to change. The manager must be continuously aware of and alert to this fact and must give continuing attention to its adequacy, operation, and maintenance.

Funds

When we consider the problems attendant to the inflow of funds, their conservation and expenditure, the manager's functions become more complex. Too often he is hindered and limited by reasons—legal, expedient, or otherwise—beyond his control. Thus limited, he must do the best he can with the funds at hand.

Operational Expense

The manager must be alert to changing labor and material costs, with the ever-ascending spiral of inflationary trends.

Financing

The financing for expansions, the handling of the capital portfolio and the sale or purchase of money, are of prime importance and need careful and continuous study by the manager, assisted by his accounting staff.

The financing policy may be pay-as-you-go, from annual income; short

Manager's Check List

1. General

a. Population—past and estimated future.
b. Area within corporation line—original, annexation to date, and estimated future.
c. Areas outside of corporation limits with possibility of being served by the utility.
d. Topography of area extended to the limits indicated by c.
e. Street and highway development.
f. Zoning, housing and land use maps.

2. Demand for Water

a. Water consumption—annual change.
b. Distribution of demand for water. Type—(Domestic, Commercial, and Industrial, and location within the area served).
c. Variation in daily and hourly consumption.
d. Relation between total population, population served and per capita consumption.

3. Availability of Water

a. Watershed or well field area—Location, topography and land use.
b. Land owned or needed for system development.
c. Rainfall, stream flow or well yield.

4. Supply System

a. Well field or impounding reservoirs.
Description of property and plan of structures.
b. Daily yield and demand—actual and future.
c. Description of structure connecting well field or reservoir with treatment and/or pumping station.

5. Treatment Plant and Pumping Station

a. Description of property and plan of structures.
b. Routine operation control.
c. Chemical treatment control.
d. Power use control.

6. Distribution System—Mains, In-town Storage and In-town Repumpage

a. System layout.
b. Record of system.
c. Hydraulics of system and residual pressures. Pressure and flow tests.
d. Daily in-town storage and repumpage operation.
e. Growth of the system.
f. Low pressure.
g. System breaks.

7. Service and meter installation

a. Description and location record.
b. Annual increase.
c. Meter testings.

8. Equipment—Inventory and Daily Operational Reports

9. Material—Continuous Storeroom Inventory

Ordering and distribution

10. Construction

a. Estimates.
b. Construction progress.
c. Final Summary—including record drawings.

11 Personnel

a. History and status of the utility's personnel—Appointment, changes, separations, absences, promotions, etc.
b. Wage and salary schedules—Standards and changes.

12. Legal Matters

a. Property Data, including Rentals and Leases.
b. Insurance Data.
c. Contractural Data.
d. Water rights and others.

13. Accounting

Accounting in the broadest sense is the final summary or indication of the utility's successful functioning and ability to continue to function. The administrative function of the manager is one of operational accounting and the manager is essentially an accountant since all data maintained by the utility may be considered as accounts.

term financing by notes, as an interim method, to be followed by pay-as-you-go funds or long-term bond issues. The specific methods, or combination of methods, particularly as they apply to municipally-owned utilities, are dependent upon state statutes or the policy of the city administration, both of which are in general beyond the manager's control or change.

Rate Schedule

The rate schedule, on which the inflow of funds is predicated, is the basic problem for the continuity of life of the utility. The manager must recognize the fact that, with the present expanding economy, there will be a continuing increase in demand for funds. To assure such change with a minimum of controversy, the manager must keep alert and realistic public information programs with the citizens of the area—in other words, cultivate a well-informed citizenery.

Certain pertinent data are necessary and essential in carrying out this responsibility. Some are mandatory to the extent decreed by the legal statutes under which the utility operates. Other data requirements are dependent upon the philosophy of the water works manager and his company as to the necessity for, and desirability of, the accumulation of data.

A proper supply of personnel must then be available for the compilation and interpretation of the desired data, otherwise the water works manager will be hampered in obtaining and interpreting the data he seeks and requires for successful operation. It is sad, but ofttimes true, that he may, through circumstances be obliged to "settle for less". In any event, he may rise above his handicaps.

Required Data

Let us review briefly the data which may be compiled from the facts available.

The first steps toward continuing good management are to install an adequate system of records and, after installation, to enforce continuance. Gathering together obvious existing data will serve as a ready source for a good beginning. Then, as the records are carried forward and expanded, the required material will be available for use in making studies and reports for all purposes. Through coordinated reports, a program can be developed from past experience, predicated upon the best possible forecasts of future requirements.

Data available for the manager should include all information outlined in the quote box in the form of a check list.

The data outlined in the checklist will be presented in varied forms and may be found as:

A. Maps
   1. Topographical, land use, and property maps.
   2. Record plans of all structure and equipment installations.
   3. General location map of the system.
   4. Comprehensive map of the distribution system.
   5. Sectional maps of the distribution system.
   6. Sectional maps for valve and hydrant location.

7. Record plat of service installations.
8. Arterial map with valve closing data.
9. Map indicating areas of inadequate pressure and breaks in the system.
10. Map of leakage survey and result.
11. Water Gradient (Free Water Elevation) contour map.

B. Diagrams - continuing
1. Population served.
2. Water consumption.
3. Operating characteristics—Discharge from reservoir, pumping head, power, or coal consumption.
4. Pressures in various locations.
5. Changing volume of in-town storage.
6. Service and meter installations.
7. Addition to distribution system.

C. Monthly Summaries
1. Treatment plant—Quantity per day, chemical analysis, chemical used.
2. Pumping Station—Quantity per day, electric power and pumping head.
3. Distribution System—Addition to system, services and meters. Activities of personnel as to installations, repairs, testing, etc.
4. Commercial—Operating income and expense, expansion expenses, financial expenses. Budget control data.
5. Materials Information—Purchase requisitions, orders, delivery slips, storeroom inventory, material delivery and cost distribution.
6. Equipment—Inventory and monthly operational data as to miles travelled and costs.

D. Deeds, Leases, Insurance Policies, and Contracts.

E. Log of pertinent events in all system activities, both operational and constructional.

F. Photographs of important events and of plant structures.

Use of Data

This is a formidable mass of information to prepare, assemble, digest, condense, and make available for the manager's use. It is meant to be so. It is costly and includes much that is often unnecessary or does not apply to the utility problem under consideration. Likewise the manager's personal background, aggressiveness, and desire will often govern the emphasis given certain phases of the assembled data. The manager must guard against such over emphasis and present a balanced presentation of the data. It should be adequate, both as to quantity and quality to provide concise, accurate and on-time information. The manager must cut his desire for data to meet these requirements. It will be asked: "of what use is all this data, especially the periodic data, other than to fill up the files?" The manager must select the data for the following purposes:

1. To ascertain the efficiency of the system's operation.
2. To plan the future of the system. This includes not only expansion, but removal and/or replacement of units to maintain its efficiency.
3. To study the capital structure of the utility looking toward the timing and method of entering the market for additional funds.
4. To construct a rate schedule for the utility.
5. To properly and adequately present the problems and activities of the utility to the city officials and the citizens of the municipality.
6. To prepare and present an adequate performance budget of requirements.

The data should be concise: It should be reviewed periodically and changed to meet the existing conditions. However the major items should not be changed so as to affect year by year comparative summaries.

Frequent changes in policy and practice with regard to charging expenses cause the results of operation to fluctuate and make it difficult to ascertain any trends.

Having decided upon the data desired for summarizing the utility's activity and the form and timing of the routine reports, the manager must "sell" the idea to the supervisory personnel. The idea must be kept sold to the supervisory personnel by frequent discussions between the manager and the supervisory force.

The maintenance of good records is the best aid to management in formulating its expansion plans and supporting its program. The results of studies will be only as good as the basic recorded data used. Moreover, the continuous compilation of statistical and financial records is more economical than an attempt to reconstruct and estimate the data for the solution of any specific problem at hand.

Administration

As the primary purpose is to keep the manager informed, all general data compiled and not reviewed by him or his immediate assistant, should be eliminated or segregated from current use. The supervisory personnel should exercise the same control over the detailed reports submitted by their subordinates.

Periodic reports of supervisors should be reviewed as soon as received and important factors discussed immediately with the personnel concerned. There must be a thorough understanding by both management and supervisory personnel of the necessity of each item of data requested and for its prompt submission, review and consideration with the supervisory personnel.

The efficient use and interpretation of these data depend primarily on the ability to furnish prompt, correct and coordinated factual information derived from it. Promptness depends upon the relative need for quick answers. Both the manager and supervisory personnel must have a full, coordinated understanding of the timing for special reports. Periodic Reports should be available before the end of the following period. Such reports, not presented promptly, unless their availability is unquestioned, are of little use. A monthly operational report 6 months old is of little value to the manager's grasp of the utility operation, especially for a large, spreading system. The financial status of the utility at the end of March is of little assistance to the manager when presented on July 1st when he is considering the operations for the second half year.

Data must be available as on-the-spot information for the manager's day by day public relation contacts. A brief daily summary of the previous day's activities, with note of special features, should be available each morning. Special noteworthy events should be telephoned to the manager's office as quickly as possible so that

he will be fully informed if contacted by the press and radio for information on the event.

Reports

A detailed weekly report of operation and construction activities, and a monthly summary of financial, operation, and construction activities are essential to keep the manager of a utility informed of the overall operation.

A comprehensive annual report serves two purposes and should be divided into two parts:

First—A general review of essential items primarily for public relation purposes within the City and for distribution to other water works managers. It should be interesting reading and present clearly stated facts of the utility's activity.

Second—A factual statement, in detail, of the plant expansion and the year's activities. Diagrams and tables should predominate. The distribution of this second part should be limited to those concerned with the utility's operation.

The data is also available for the numerous special reports required from time to time.

Public relation activity, both in the form of talks to civic groups and visual exhibits during special civic activities lean heavily on comprehensive clear interesting summaries of data.

One of the principal concerns of the public utility manager is the fixing of the annual budget and provision for its control. An important factor in control is to prevent diversion of funds or activities to non-waterworks projects. The question of accounting on a cash basis is satisfactory if the manager and his financial subordinate remembers that within 4 months there will be a large payment for interest and capital retirement. Likewise, the absence of a storeroom account, even for coal on the ground, makes periodic cost analysis difficult. If detailed continuous comparative costs are desired, accrual accounting and a storeroom account are essential.

The need for close coordination of engineering assistance and management in financial matters is both apparent and great.

The manager's needs of engineering are to name a few, those connected with planning improvement, cost estimating, design of plant facilities, preparation of specifications and contract documents, supervision of construction, direction of physical operations, and correlation of cost records with construction work, proper maintenance of plant investment accounts, appraisals of property, cost analyses, studies of rate structures, studies of depreciation rates and reserve requirements, forecasting of revenue and expenditures and analysis of the financial results of operation. The selection of those data to be catalogued is of extreme importance since record keeping is an expensive process.

Water utilities as business enterprises are characterized by high capital investment per customer and per dollar of revenue derived. The normal water utility is an ever-expanding business. The very nature of its operations places the engineer at the top of the list of staff advisers in formulating plans. Successful, economical operation of the utility is essentially an engineering job. The costs are created by engineering; their interpretation, often by applied common sense, a real attribute of the engineer. The engineer's tools are data—their use requires the manager's skill.

Customer and Public Relations

by O. A. NEWQUIST, Manager
Monmouth Consolidated Water Co.

■ MANY BOOKS and papers have been written on the subject of customer relations and dealing with the public. The purpose of this paper is to merely present some of the author's observations.

It is best to begin by defining the words used in discussing this subject:

Water Works—a system of wells, dams, structures, pipe, motors and pumps for furnishing a water supply.

Manager—one who directs or carries out a plant wth skill.

Relations—conditions in general, or dealings with others.

Customer—one who purchases or consumes a product.

Public—relating to a government office or professional activity.

All of these words have a definite part to play in the plan of good or bad customer and public relations. One can re-arrange or even scramble the words—you still come up with "relations" as the problem.

Historical Perspective

Public relations can be traced back to the time of Adam and Eve. In disregarding a rule of regulation of Eden, they created a problem for themselves. Also back around that time water became a problem to Noah and his family after forty days and nights of rain.

Moses might be considered the first water works man faced with a problem of supply and demand. He created the first water works by smiting the rock and also held back the water of the sea so the Israelites could cross. People have been faced with water problems to this day. The solution to many of them may be found through good public relations.

The Customer

The water works manager must

know his customers. The person who relies upon water most for everyday use is, of course, the housewife. She is usually the one who visits the office to pay the bills and who usually registers any complaints.

The customer wants to be inconvenienced as little as possible. Quick responses to emergency calls involving repairs on mains and service lines save trouble not only with the customers but the public officials as

well. Immediate repaving of streets and clean-up when a repair job is completed eliminates many inconveniences to the public.

Appearances

The public is concerned about the appearance of the area surrounding water supply sources, the treatment plants, offices and equipment. Clean facilities which receive a new coat of paint when needed are pleasing to the eye and the small expense involved is cheap compared to the value of goodwill received.

Reservoir grounds should be planted with suitable trees and shrubs and kept clear of debris. These areas were at one time restricted to the public but now are being used as parks with boating and fishing permitted.

Information

The public should be kept informed of the activities of the water company. Employee retirements, promotions, additions of new equipment, and plans for bettering service are only a few items worthy of publication in the local newspaper. The newspaper reaches nearly all the customers and should be used to place ads of an educational nature. The people want to know where their water comes from and the difficulties encountered in getting it to the tap.

The treatment plant should be open to all visitors. School children taken on plant tours will surprise you with what they can absorb and talk about at home. If the children can't be taken on tour, go to the school and tell them the story of water.

A close association with the local radio and TV stations is an asset. They can be of assistance during emergencies by informing the customers of breaks and the time required for repairs. Water shortages are effectively advertised by this method.

Personnel

Since a company is only as good as the personnel who represent it, the selection and training of everyone from the painter to the manager is very important. If these people enjoy their work, they will be more cheerful, courteous, and show a sincere interest in the customers welfare.

Personnel can improve or destroy good will with the customers. Nothing makes the customer or public in general more angry than an exhibition of bad manners or carelessness on the part of an employee. This is especially true of those employees who are in intimate contact with the customer such as cashiers, clerks, telephone operators, meter readers and service personnel.

Meter readers in particular should be neatly uniformed for identification and prepared to meet all members of the family including the dog. A pleasant smile and a word of greeting always leaves a favorable impression with the customer. If a manager receives a note of praise concerning an employee, he should pass this on to the person involved. This always boosts the employee's pride and interest in his work.

Manager

When an employee fails to do his or her job, it is always the manager's telephone that rings. This is the time to use tact and be a good listener. All complaints can generally be settled fairly for all concerned if the manager is patient and remains calm, no matter how rough the treatment.

The job of manager of a water utility is not the set work routine most people consider it to be. There are many interruptions during the work day and many evenings spent on emergency problems or attending meetings. These are all part of the public relations program. Here are some standards which a manager should abide:

1. Treat everyone on an equal basis and show no favoritism regardless of the person's position.
2. Be honest. If you don't know the solution to a problem, say so, but explain that the subject will be investigated.
3. Meet engagements to which you have been committed and be on time. Accept responsibility and do jobs well.
4. Be courteous and pleasant and mean it.
5. Do not argue or complain.

A utility manager should take an active part in civic affairs. In so doing, he will come in personal contact with business leaders and public officials with whom various subjects can be discussed and a mutual understanding created. Always be careful to stay away from controversial problems which don't affect the utility directly.

Conclusion

Whether you work as a manager or at any other position, you can take cheerfulness, willingness and courtesy with you. By so doing, the days' burdens are lighter and fatigue is kept away. Therefore, depression is not given a chance to envelop you.

Such an attitude not only makes you good company for yourself but for others as well and it soon becomes contagious and everyone you meet adopts the idea. Then your work becomes a pleasure.

Talk water works whenever you have the opportunity because being a manager of one is a bigger job than many realize. It presents a real challenge and one where you can not sit back and rest on past accomplishment. Everyone of your customers is Your Boss, each one expects to be served a water supply that is clear, safe and potable at pressures and in quantities to meet all demands such as lawn sprinkling, industrial use and fire flows for adequate fire protection and expects that all maintenance will be kept up to date. It is the manager's job to see that the company is operated efficiently and economically so that the rate per thousand gallons is fair and reasonable. By so doing, the customers and public will be pleased with your efforts as the manager of the water utility.

Work To Be Done

by JOHN H. MURDOCH, JR. President, Pennsylvania Water Works Association

■ DURING our sixty-second annual meeting eight talks were addressed to the managers of water companies by Abel Wolman, Frank Amsbary, Fred Merryfield, Fergus McDiarmid, Dav-

id Dunlap, Wendell LaDue, Oscar Newquist and Joseph Beck. It is gratifying to have been able to persaude these leaders in our industry to prepare and deliver these talks. They have spoken on a number of different phases of a water works managers character and work. By bringing into one unit the thoughts of each and all of the speakers we develop a composite description of the ideal water manager. We find this paragon to be a philosophical, idealistic, foresighted businessman; skilled in the principles of water works engineering, of corporate finance, of economics, of accounting, and of public and human relations.

One man with all of those qualities would indeed be a paragon. The composite is truly the ideal toward which all water works men should work; the ideal to which the water works industry should direct attention; the idea to be approached through dedication and training. This Association and others can help to bring many to a close approximation of the ideal by offering and urging attendance upon training courses and by offering rewards commensurate with the worth of the individual's character, training and skill.

We have not all been paragons. Perhaps if we had been blessed with such manners in all systems over the years all of our problems would have been solved. Perhaps, but unlikely. Indeed one of our blessings is that new problems keep developing all the time so we never reach the stage of having nothing new to learn, of having no demands on our brains. We have accomplished much but much still remains to be done.

Work We Have Done

Safe water for domestic use has been made available for all urban communities. The scientists learned the water borne source of many diseases—we learned how to make water safe for human consumption and we learned and applied the engineering and financial skills required to deliver safe water to the consumers. We made such water available at costs low enough to be attractive to a largely indifferent public. In fact, we have even gone so far as to make safe water usually palatable so that people like to drink it.

We have made water under pressure available in urban communities for fire service. It is true we seldom offer fire service facilities completely up to fire underwriter's standards but we usually come close. We usually offer facilities more closely approaching those standards than do the other elements of the community's fire prevention system. We keep fire insurance rates low by reducing to a minimum the chances of a conflagration.

We attract and hold business and industry in our centers of population —business and industry on which the community depends. We attract and hold them by supplying the water without which they could not function.

We make life pleasant and easy in in urban homes. Except on some vacations no city dweller once having experienced the pleasures of a home well equipped with water facilities, would willingly go back to the discomforts and dangers of the simple life.

In short we have made the modern city possible. We have learned the sciences and arts of securing, processing and delivering water to consumers. We have a right to be proud of what we have done. We have not, however, done all that we know how to do and there are some arts we have not yet learned.

Work Yet to Be Done

When we think of supply we are forced to admit most of us are shortsighted. Recently in talking to a representative of a water system he remarked they had ample supplies, their reservoirs were full. He then went on to say 1957 had been a dry year and the reservoirs were practically empty at the end of the year. His city was not growing but—yes, the surrounding area was growing rapidly in population and his city supplied water to this territory. When asked what he would do if last year's weather were repeated in 1959, so that 1957 supplies would be called upon to meet 1959 higher demands, he did not have an answer because the question had never entered his mind. We have not yet fully learned that water use is increasing, that dry years do come, that use is higher in dry years because water is then more useful, that source of supply works must be planned and built years in advance of probable need to have them ready for possible need. As Wendell LaDue wrote years ago: "In water works practice, ten years from today is now." An overbuilt source of supply system may, in theory, be a possibility, but I never knew of one. There are hundreds which are inadequate.

Inadequate distribution systems are so common that their victims sometimes do not think of them as weak. In some sections water works men have done such a thorough job of selling the public excuses instead of service that chronic low pressure in certain sections, chronic restrictions on the use of water at certain hours and for certain uses, are tolerated even though resented. Such service lacks are always resented even by customers who understand that water works poverty is the excuse. In Arizona where water is considered to be valuable, customers get the water they want, when and where they want it. California water companies are expected to give adequate service at all hours of every day. Too many of us have not learned how to render that kind of service.

There appears to be much which yet remains to be done in connection with financing our systems. With rapid growth of demand and expansions of territory, coupled with increases in costs of materials and labor, the day of financing improvements and replacements largely through depreciation allowance and retained earnings, with an occasional long term low interest bond issue, has passed. We have not yet found the way to make water company securities attractive to present day investors. When investors are not interested in saving merely to keep their dollars but save only to be able to buy things which can be exchanged for a greater number of dollars as the purchasing value of the dollar declines, then we are facing trouble in water company finance. One of the arts we must learn at once is the art of convincing the public and the regulatory commisisons that they cannot get satisfactory service from an emaciated wreck. We must be put in position to get the nourishing capital needed to make us financially healthy.

Areas for Improvement

Much work still needs to be done in learning and applying business methods in the management of our systems. Consider some illustrations.

We do not assemble the data which a manager should have. We care-

fully assemble all the dollar figures required by the prescribed classifications of accounts. Good. Somewhere (usually well hidden) there will be facts about the number of man hours devoted to various functions. These data, if ever found, are seldom studied to determine the man hours per various units of service. Unless you have such facts how can you know that your rising labor costs in dollars reflect merely increases in wage rates? Perhaps poor organization, too much overtime, poor supervision, may be the real cause. It is possible that the high pumping costs are more directly due to poor pump design, higher than necessary friction head (or again to unnecessary labor costs) than to increased cost of fuel or current. Get the facts.

Having obtained the facts, study them for the lessons they can teach for the future.

Water works managers must develop ingenuity and courage. At the risk of being laughed at, here are some suggestions for you to tear apart.

One of the heavy costs of water works operation, in fact, of all utility operation, is in customer meter reading, billing and collecting. There is good reason to believe that a jointly organized, owned and managed enterprise could do the work for the water, gas, and electric utilities in a community with very substantial savings for each.

We know that water works managers need to have available to them in readily usuable form many data concerning their operations which they cannot make available because of the high cost of assembling and digesting them. A very large system may be able to afford either the capital or the rental cost of a modern business processing machine but they are out of the range of the possible for most. Again, an enterprise organized to serve dozens or even hundreds of water systems could do the work by modern methods at a cost which all could afford to pay.

There are problems regarding main extensions which might be solved with ingenuity and courage. When new territory is opened for development through the laying of water mains all of the real estate within reach of that main at once increases in value. Each property owner receives a benefit even though not served with water. The property receiving this "unearned increment" of value might in equity be required to pay to the water utility an "availability charge" based on the number of feet of frontage benefited. This would reduce the cost to those presently needing the extension and keep existing customers free of added capital costs not required for their service.

There is much work to be done in keeping costs down or reducing them. Water works managers must do all in their power to counteract rising prices and wage rates with the tools of greater efficiency. Units of production must advance faster than costs or inflation results. Better organization, better tools, better trained and more productive work forces are essential.

In the end, all the effort toward better water service, better business methods, will lead to dead ends unless water works managers succeed in winning the intelligent good will and understanding of the public and general acceptance of the paramount importance of fully adequate service. Once let the public accept that truth and commissions will begin to give efficiency or operations the rewards to which it is entitled and which under present commission practice are denied to it.

There is still much work to be done.

Health, Safety and Non-effective Time

Effective health and safety programs of the water and sewage works industry save needed man-hours. A reference to compare local standing to the nationwide experience has been published from the U. S. National Health Survey.

The report gives selected statistics on acute conditions, chronic conditions, persons injured in accidents, physician visits, dental visits, and disability.

Illness or injury caused by the American people to stay home from work, stay in bed, or otherwise cut down on normal activities for about 3 billion 400 million days during the fiscal year 1958. This total of disability averaged 20 days per person per year.

Acute illnesses, including acute respiratory conditions, totaled 437,900,000, or an average of about 2.6 per person. How many of these illnesses were caused by Asian influence is not known. However, the report shows that acute respiratory conditions caused an average of about 7 days of restricted activity per person, including days in bed or days lost from work or school.

About 47,000,000 persons are injured seriously enough during the year to cause them to restrict their activities for a day or more or seek medical attention, the report shows. Injuries caused 424,100,000 days of restricted activity, or 2.5 days per person.

The importance of chronic conditions is indicated by the fact that circulatory diseases alone were the cause of 484,200,000 days of restricted activity, which would be the equivalent of about 2.9 days per person. The circulatory diseases rank higher than any other group of chronic conditions in this respect.

People visited their physicians 889,900,000 times, or an average of 5.3 times per person. People also went to their dentists 269,200,000 times, or 1.6 times per person on the average.

For most of the topics covered, the figures are shown by calendar quarter, pointing up the seasonal differences. Age, sex, and rural-urban residence are also shown in most instances.

The publication "Selected Survey Topics, U. S., July 1957-June 1958" is Public Health Service Publication No. 584-B5. Copies are for sale by the Supt. of Documents, Government Printing Office, Washington 25, D. C., at 40 cents a copy.

"Okay, Buddy, what's your hurry?"

Over a thousand jammed meters, constant, extensive flushing of the distribution system, were eliminated by the installation of a system for . . .

Desanding Municipal Water Supplies

by M. H. ALEXANDER, Superintendent,
Water Department, Hobbs, New Mexico

DESANDING units serving four deep wells, illustrate grit collection chambers below each unit.

■ HOBBS, A MODERN CITY of 30,000 population situated in the southeastern corner of New Mexico, is the center of one of the last great oil booms. In 1927 the community consisted of only a general store and a windmill. Discovery of oil a year later ushered in a boom which was to increase the population to 20,000 in two years. Like just about everything else, the Hobbs boom subsided in the early thirties, but was revived a few years later when activity in the oil industry was once again resumed.

The extremely rapid growth of Hobbs quite naturally resulted in growing pains and produced a number of municipal problems, particularly in the post-war era. One of the foremost of these was development and maintenance of an adequate water supply. The original water system serving the town was installed by The Hobbs Water and Gas Company, an independent public utility. Water source was a series of deep wells.

Storage and Sand Problems

In 1946 the City purchased the water system which at that time was plagued with two major problems—inadequate facilities and considerable quantities of sand in the water. One of the major inadequacies was shortage of storage capacity as no ground storage facilities and only 300,000 gallons of elevated storage were available. The source of sand was deep wells which were pumped in the distribution mains with no provision for desanding.

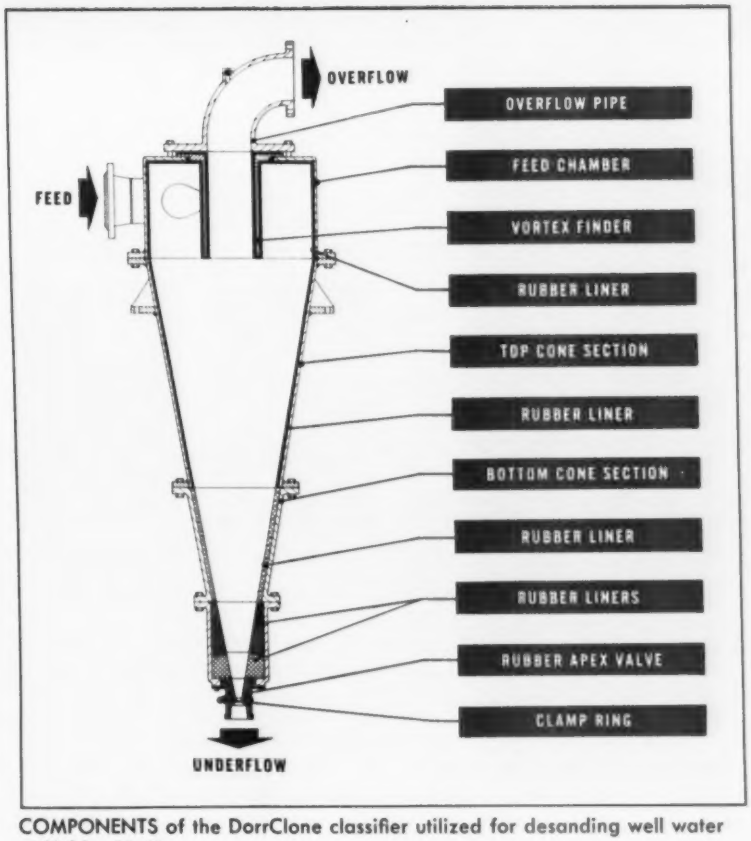
Operating under a Board of Water Commissioners, the Hobbs Water Department has extensively expanded and improved facilities in the past ten years. Nine new deep wells have been drilled and two booster stations built. Three ground storage reservoirs with a total capacity of three million gallons and two elevated steel tanks with a total capacity of 1½ mg storage have been constructed. The last of the tanks was completed in the spring of 1958.

With this substantial increase in both storage capacity and number of working wells a reality, the Department began to concentrate on the second major problem. The entire distribution system was loaded with sand. Water pumped from the wells contained as much as 100 parts per million of sand, 90% of which was in the 48 to 200 mesh size range. As it passed through the system, this sand jammed water meter rotating discs at an alarming rate. A survey

Table 1

Operating Results—Desanding Well Water

	Average	Maximum	Minimum	Total for 70 day period
Flow, gpm	1129	1175	950	-----
Flow, MGD	1.26	1.51	0.60	88.3
Pounds of sand removed per day	673	1325	118	47.150



COMPONENTS of the DorrClone classifier utilized for desanding well water at Hobbs, N. M.

in 1956 showed 1,576 jammed meters passing unregistered water at one time or other. The entire system has over 7,000 water connections.

In early 1956 the Water Department began an investigation to determine a positive and yet economical method of removing this sand and silt prior to storage and distribution of the water. After the investigation it was decided to test a DorrClone Desanding unit on a trial basis and a pilot installation was erected and an extensive test program begun.

Desanding Test Proves Successful

The complete system consisted of special wet cyclone classifier, complete with underflow chamber, feed pump, piping and supports. The unit itself, is a cylindro-conical shell 24" in diameter and provided with feed, underflow and overflow outlets.

During the testing period raw well water at approximately 43°F and with a pH of 7.0 to 8.3 was pumped to the system at a rate of 950 to 1175 gallons per minute and pressures of 125 psi. Solids contained in the water have a specific gravity of 2.65. Designed for a 325 mesh separation or finer, the unit removed an average of almost 700 pounds of sand and silt per day. Size analyses of the solids showed the cyclone removed 100% of the plus 150 mesh sand and over 90% of the plus 200 mesh material.

While the unit does not, of course, remove all of the sand from the water, it does remove the great majority of the plus 200 mesh solids—that fraction that is the greatest source of trouble in the distribution system. An indication of the amount of sand removed as well as the total volumes of water treated is evident in the table which summarizes results from a 70 day test at Hobbs.

On the basis of the test results of the pilot installation, the Department ordered an additional nine systems, one for each deep well. Each unit was of the same size and general construction as the original cyclone and is equipped with a 4" disc type apex valve and grit chamber. Beneath each grit pot is a 2" rubber lined manually operated quick opening diaphragm valve for emptying the underflow chamber.

Operating in a highly satisfactory manner for more than a year, these systems effectively eliminate influx of new sand in the system. They discharge a clear overflow at positive pressure into the ground storage reservoirs which also have built-in sand traps. From there the water is boosted into the mains.

The previous extensive flushing program of the distribution system has now been practically eliminated, and the residual sand in the lines is nil.

PUMPHOUSE showing desanding unit. Underflow chamber discharge is controlled manually.

The first meeting in the second half century featured

Operation Helpmeet

EDITORS NOTE: The location of this meeting at French Lick the famous Indiana resort during the off season gave an excellent opportunity for getting together to discuss mutual problems. Concurrent meeting on distribution and production made up the technical program. The luncheon featured Lauren Grayson speaking on "Do it Now" while AWWA President Lou Finch took the rostrum at the annual banquet on the subject of "Operation Helpmeet".

L. S. Finch
Pres. AWWA
Banquet Speaker

Lauren W. Grayson
VP AWWA
Luncheon Speaker

■ THE NEW chairman of the Indiana section is Harvey Wilke, Assoc. Professor of Sanitary Engineering, Purdue University who will succeed Leo Louis, Vice President & General Manager of the Gary-Hobart Water Corporation. Lou Finch, AWWA national President, spoke to the water works men's wives at the banquet on their being helpmeets. A clear explanation of why water improvements or rate change are necessary and a reflection of the pride they feel in their husband's work presented over the bridge table will do much for promoting the water works industry. Several of the papers presented at the technical session are reported in condensed form here.

■ TREATMENT PROBLEMS OF GROUND WATER by T. E. Larson Head, Chemistry Section, Illinois State Water Survey Division, Urbana, Illinois.

Although there are innumerable problems in producing at the water works a quality product which meets both the needs and desires of the consumer, a real problem which has received little attention is supplying the same quality of water at all points in the distribution system. This is really a problem in supplying good quality water at the dead ends. One attempt at a solution has been to increase chemical dosages. This approach, utilizes rather large quantities of chemicals and disregards the substantial cost increases, raises some question as to whether the threshold of physiological effect is being approached. In many cases this attempt provides only a minor degree of improvement.

Difficulties of this type are usually acute in communities with small population spread over a considerable area. A water system with a normal demand in the order of 30,000 gpd and with something like five to ten miles of four and six inch pipe hydraulically designed for fire protection demand and with no unilateral dead ends, will have many areas of low flow. It is not uncommon to find that a water which has been softened at the treatment plant is delivered to consumers in one of these areas of low flow in a scarcely recognizable condition. It was calculated in one instance where this problem has presented itself, that normal flow rates would require 60 to 130 hours for water to travel from the plant to the home.

The most promising solution to this problem considered to date is to provide circulation of the water from the end of the system back to the treatment plant by pumping. In the instance referred to above forced circulation or recirculation would affect the time of passage from the plant to the consumer as follows:

Recirculation Rate (gpm)	Time of Passage (hours)
0	65
25	14
50	8
150	3

As can be seen from these data the point of diminishing returns in reduction of time of passage is apparently reached at about 25 gpm.

On the basis of work by Prof. John Guillou, Department of Civil Engineering, University of Illinois who supervised the hydraulic calculations reported in this paper, it is estimated the recirculating 25 gpm would cost about $150 per year. In most instances of this type, the cost of the usually frequent hydrant flushing done to try to alleviate the situation will approach that figure.

An additional advantage to recirculation is that chlorine residuals can be maintained throughout the system. At present it has been found that, in distribution systems of this type a residual can be found only about one third of the way from the plant to the end of the system.

One factor which would aid in the design of circulation into distribution system would be the use of a valve or valves to react to the changes in pressure drops in the system brought about by fire demand.

■ REPORT OF A STUDY TO DEVELOP MORE EFFECTIVE TREATMENT OF LAKE MICHIGAN WATER by M. B. Gamet, Professor of Civil Engineering, Northwestern Technological Institute, Evanston, Ill. and J. M. Rademacher, Sanitary Engineer, USPHS, Chicago, Ill.

The object of this study is to de-

termine all of the causes and all of the variables which are involved in the problem of short filter runs in filtration plants. This involves among the more important items.

1. Water quality conditions and
2. demands in so far as volume of treated water is concerned
3. concentration and distribution of plankton or algae in the lake
4. weather condition, temperatures, lake current conditions, etc.
5. chemical dosage.

The project started officially as far as field studies are concerned on January 1, 1958. It was originally intended to be conducted through a 12 month period but the water quality conditions and the demands on the plant were not as severe as had been anticipated, and had actually been experienced in previous years. As a result it was decided with the concurrence of the plants involved to continue through another year.

The participating plants are Green Bay, Sheboygan and Milwaukee in Wisconsin; Waukegan, Evanston and Chicago, Illinois; Gary-Hobart and Michigan City, Indiana and Benton Harbor, Holland, Grand Rapids and Muskegon, Michigan.

Data from these plants is collected on a daily basis on special forms which are transmitted to the U. S. Public Health Service regional office in Chicago. Mr. John Rademacher who is a Sanitary Engineer in that office and Prof. Gamet are analyzing the data. This is a major task because of the volume of data which is involved and also the number of variables which influence the problem. During the period which the field study has been conducted analyses have been conducted to evaluate the significance of these variables. Since to date it has been done manually the work is an almost impossible task except on a spot check basis. Work is now nearing completion on placing this data on IBM punch cards and it is expected presently to start correlation and computation with the IBM 650 computer at the Northwestern University Computer center. Because of the mass of data it is felt that this is the only way in which complete information regarding all the plants and all of the various conditions under which they are required to operate can be obtained.

Insuring that the data on organism counts would be accurate has presented somewhat of a problem and required a considerable amount of work. This has been due to the lack of experience on the part of plant personnel and the always present problems inherent in identification of the organisms. To overcome this difficulty clinics have been held with the assistance of Dr. C. M. Palmer of the USPHS Taft Sanitary Engineering Center. This approach has improved the accuracy and confidence of the counters and it is felt that the accuracy is now as good as can be expected considering the conditions of the study.

Leo Louis
Retiring Section Chairman

Harvey Wilke
Incoming Section Chairman

A number of theoretical analyses have been made of the data on a manual basis which indicate trends, but as yet no conclusions can be drawn except in a very general way.

One of the things which has been under study is an attempt to develop a filtrability index. This phase of the work is pointed at eventually being able to predict if possible the filtering quality of a water. This would include the organisms present, the turbidity and the treatment which is given the water. The first work was done by using a woven wire fabric disk and determining the resistance or head loss as a sample is passed through the disk. Similar work on this phase is also being done under an AWWA task committee. The results with the wire disk have not been too successful and work is now being conducted using the membrane filter. It is felt that the membrane filter will catch all of the organisms as well as suspended solids while the wire disk will not until a mat has formed on it.

These troublesome periods are primarily during the cold water, low turbidity periods. These are times when coagulation is difficult although organism counts are generally low.

■ CROSS-CONNECTIONS by W. D. Shillinger and G. G. Fassnacht, Sanitary Engineers, Indiana State Board of Health, LaPorte and Indianapolis.

Water with a hardness of 130 ppm in one section of a town supplied with ion exchange softened water is typical of the warning signs given today by cross connection. In this particular case it was found that one of the local industries was no longer able to use its well supply for process water due to increased hardness. In order to keep water costs down just before meter reading time sufficient well water was pumped back through the meter to reduce the reading. In another similar instance red water complaints were received in a small section of the city. The plant engineer at a local industry was quite indignant during the discussion of his possible connection to the problem until the plant water meter was found recording 30 gpm going backwards.

Although legislation to control cross connection has been on the books in Indiana for many years there are still cases of unauthorized and unprotected installation.

■ TRENCHING AND SHORING bl Alden P. Knapp—E. R. Knapp & Sons, Inc., Contractors, La Porte.

The noise, mess, confusion and annoyance associated in the home or business owners mind with sewer or water line installation is rapidly becoming a thing of the past. By using the latest techniques which include rubber tired cranes, trenchers and other equipment the job can be done with a minimum of fuss. One technique which although it increases the cost greatly reduces the unsightlyness of trenching is hauling away of the spoil rather than piling it along side the ditch. With this method the excavated earth is loading directly from the trencher to trucks. This method may be further modified again at increased cost by return fill of a granular nature suitable for rapid compaction thus reducing the time interval prior to replacing the road surfacing. One problem in connection with this approach which has not been resolved is the effect on the pipe resulting from the use of equipment which can compact the entire ditch at one time rather than compacting in layers as has been done heretofore.

The Golden Anniversary meeting features

50 Years of Progress

a meeting report
by WILLIAM A. CAWLEY
Associate Editor

EDITOR'S NOTE: On Feb. 16-17, 1909, 37 water works officials met at the University of Illinois and formed the Illinois Water Supply Association. Five years later, this group affiliated with the AWWA and became the Illinois Section of the parent group. On March 11-13, 1959 water works men from all over the country gathered in Chicago to help the Illinois Section celebrate the 50th anniversary of that first meeting in the State.

■ A JOURNEY INTO IGNORANCE the banquet address by Mr. Richard J. Anderson of Columbus, Ohio was a humorous description of the satellite program and other facets of the International Geophysical Year. Armon Lund, Superintendent of Public Works, Wilmette, Ill. was elected to succeed Dr. T. E. Larson, Assistant Director and Head Chemistry Section Illinois Water Survey as Section Chairman. Distinguished guest included Lou Finch Pres. AWWA, Harry Jordan, Exec. Sec. AWWA, Bill Orchard, Treasurer AWWA, many past-presidents of AWWA and others equally distinguished. Abstracts of several of the paper are presented.

THE ILLINOIS WATERWAY—HISTORIC REVIEW AND OXYGEN CONDITIONS by E. Hurwitz and G. R. Barnett respectively Director of Laboratories and Senior Chemist, The Metropolitan Sanitary District of Greater Chicago.

Since 1840 when Chicago had a population of only 4470 Lake Michigan has been the source of water for the community. From the time the first sewers were built in 1856, until the construction of the sanitary and ship canal, the lake was also the point of discharge, either directly or indirectly of all the sewage of the community. As the city grew conditions deteriorated until by 1885 the pollution of the water supply menaced the health of the entire population. After an intensive study beginning 1886 the state legislature in 1889 created the Sanitary District of Chicago which

T. E. Larson
Retiring Chairman
Ill. Sec. AWWA

Amond Lund
New Chairman
Ill. Sec. AWWA

following the recommendation of the 1886 study constructed the Chicago Sanitary and Ship canal diverting the Chicago river into the Illinois. In addition the canal pumping stations and intercepting sewers were built and improvements in the sewerage system were made to conduct the sewage of the district to the canal.

By 1909 the growth of Chicago had increased the pollution of the waterway to the extent that dilution of the sewage with lake water would have to be supplemented and sewage treatment studies were undertaken.

The main drainage channel was opened in 1900 with flow limited to 5000 cfs. Objection of this diversion was first made in 1900 by Missouri on the basis that it polluted the Mississippi which is the water supply of St. Louis. The court found that, the sewage from Chicago never reaches St. Louis due to the self purification of the Illinois river.

Opposition to diversion increased from 1910 and culminated in a decision by the Supreme Court in 1930 which provided for step wise reductions in the amount of water diverted from 6500 cfs in 1930 to 1500 cfs in 1939 and required sewage treatment by the Sanitary District.

A program for the construction of sewage treatment was in progress and although delayed by war and depression by the end of 1949 complete treatment for all the sewage pumped to the district was provided.

The effect of the reduced diversion and treatment program is best shown in table 1 which shows the DO at two points on the Illinois river.

Table I
Summer Oxygen Condition in Illinois Waterway

Year	Lockport Discharge cfs	Oxygen ppm Lockport	Oxygen ppm Smith Bridge
1928	10,330	0.3	—
1938	6,900	0.2	—
1939	3,200	0.0	0.3
1948	4,000	0.1	2.0
1958	3,700	0.5	3.5

DESIGN FEATURES OF THE CHICAGO CENTRAL DISTRICT FILTRATION PLANT by George S. Salter, Chief Filtration Engineer and Fred G. Gorden, Asst. Chief Engineer, Bureau of Engineering, Chicago, Ill.

With a rated capacity of 960 mgd at 2 gal per minute per sq. ft. and with capacity to handle 3.5 gal per minute per sq. or 1700 mgd the Central Works will be the largest filtration plant in the world. More than 5 miles of deep rock tunnel was constructed to connect the intake cribs to the

plant and the plant to the distribution tunnels.

Built on an area reclaimed from the lake the plant equipment is somewhat similar to that of the other Chicago plants. Filters have common wash water gullets and cast iron pipe bottom. The filter bottom used was determined on a bid basis.

FIFTY YEARS EXPERIENCE WITH WATER WORKS COSTS AND REVENUES by L. R. Howson, Partner, Alvord, Burdick and Howson

In 1908 the regulation of public utilities as it is today was unknown. Wisconsin had its Railroad Commission but other state regulatory bodies were not yet in existence. Most of the central-west water works systems had been built in the two decades from 1880 to 1900. Many of them were originally constructed by private companies operating under franchise, usually running for a 20-50 year period. As these franchises were expiring many of the cities exercised the option to take over the system rather than renew. The extended litigation connected with the purchase of some of these installations produced decisions which established public utility law.

By 1920 many states had created public utility commissions vested with the responsibility of fixing value for rate making purposes and fixing rates fair both to the utility and the public.

Originally municipal plants had to be financed by general obligation bonds and financing of necessary water expansion was sometimes difficult or impossible. Approximately 25 years ago most of the states enacted legislation authorizing revenue bond type financing. In this type of financing the bonds were a lien on the water works property and its revenue only but the cities convenant to provide the revenue necessary to pay the interest and amortization on the revenue bonds. This type of financing has been highly successful with the result that for the past several decades municipalities have expanded their water systems at a much more rapid rate and materially faster than the private companies. For illustration a comparative study made of investment growth in private and public plants from 1925 to 1945 showed the municipal rate of investment in new plant during those two decades to be 2-½ times that of the private companies. In the next ten years from 1945 to 1955 the municipal water works growth in investment, percentagewise, was four time that of the private companies. As a result the outstanding water works debt, expressed in dollars per capita served, of municipal water works in 1955 was doubled what it was in 1945.

Revenues and Construction Costs

As of 1910, 102 plants for which the statistics were available showed the average revenue per capita to be $2.62. The 1955 "Statistical analysis of Water Works Data" by Messrs. Seidel and Baumann (Vol. 29 No. 12, December 1957, AWWA Journal) showed a revenue averaging $10.65 per capita for public plants and $12.16 per capita for private plants with a weighted average of approximately $11.00 per capita or something more than 400% of the per capita revenue secured in 1910.

L. R. Howson
Water Works Cost and Revenue

E. Hurwitz
Illinois Waterway

The Alvord & Burdick 1910 study showed the weighted average investment in 102 water works at that time to be $25.20 per capita. The Seidel-Baumann study of 1955 data showed an average book value of public plants at $82.00 and private plants $68.00, or a weighted average of approximately $80.00 per capita, a figure 3-1/6 times that of 1910.

It is interesting to note from the Seidel-Baumann figures that the book value of public plants had increased $30.00 per capita in the period from 1945 to 1955 whereas the book value of private plants had increased but $8.00 per capita. This 4:1 ratio of investment growth in public as compared to private water works is believed to be largely due to the reluctance of regulatory commissions to recognize the changing economic conditions in their determination of the rate base and rates.

FIFTY YEARS PROGRESS IN OUR KNOWLEDGE OF WATER SUBSTANCE by A. M. Buswell, Professor of Chemistry, University of Florida, Gainsville, Fla.

Progress in the field of electronics has provided new tools which have facilitated increases in our knowledge of the substance of water. Dielectric equipment, infra-red machines, spectrophotometer, X-ray equipment and microwave sets are but a few of the tools which have been put into the hands of the researcher in the past 50 years. Around 1909 it was believe that water in the liquid state consisted of two HOH's held together by a hydrogen bond, as a gas it was a single HOH molecule and the solid state, ice, was made up of three HOH's also held by a hydrogen bond. By 1920 this theory was losing favor as X-ray work showed four molecules connected in ice. Work with gas hydrates along with other approaches continually added to our knowledge until today water is known to be a complex, active reagent in which the molecules exist not as individual particles but as a continuous magna under-going c o n t i n u o u s change.

WATER WORKS ADVANCEMENT by James B. Corey, AWWA, N.Y., N.Y.

Water works advancement must be supported by public opinion. To gain this support the value of an efficient water system must be sold to the public. Only when quality performance is given will public support be obtained. The Water Works advancement program is intended to supply the professional knowledge needed to do a good job and the tools to sell this good job to the public.

On the professional advancement side a pilot program of management courses is being developed with the aid of the small business administration.

A beginning is being made to gather the information needed to establish a personnel service. Questionnaires forthcoming in Willing Water will be the first attempt to gather this data.

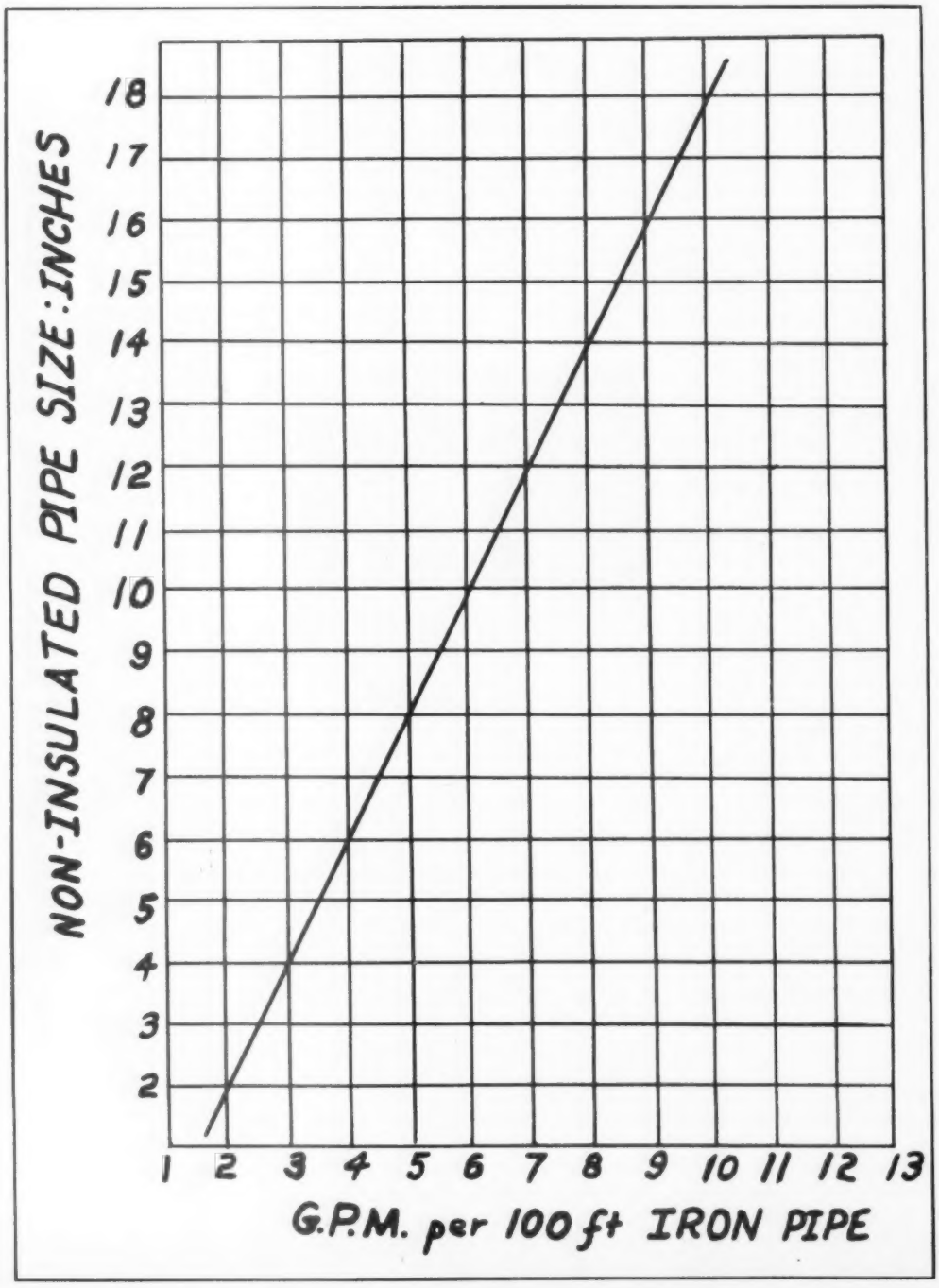
Also forthcoming will be quarterly blue supplements to *Willing Water* for the attention of Mayors, Water board members, etc. The information contained is intended to keep them up to date on water works progress.

Maintaining Water Supply Lines at Zero Temperatures

Curve indicated on nomograph is for steady flow pressures and wind velocities of 15 mph. If wind or pressure fluctuate, increase flow rates.

Sample problem uses 8 in. pipe on 250 ft run with temperature —20°F. Curve reads 5 gpm and flow is 2.50 x 5 or 12.5 gpm. If conventional hair felt and waterproof coverings are used the values can be reduced by 10 percent. Increased winds require the bleed off to be 25 gpm.

by T. K. ANDERSON
Oak Ridge, Tenn.



REPORT FROM ABROAD

During the past 15 years there have been some interesting developments in . . .

Wastewater Technology *in Germany*

Part II

by Dr. Ing. H. RHODE, Chief Engineer
Ruhr River Association
Essen, Germany

EDITOR'S NOTE: In this second part of a two part article on recent progress in sewage treatment technics in Germany, the author discusses secondary treatment and sludge digestion. Part II was also translated by our Contributing Editor, Clarence E. Keefer, Deputy Sewerage Engineer, Baltimore, Md.

■ BEFORE THE WAR and during the first years after the war, trickling-filter treatment dominated what was done in Germany in respect to the biological treatment of sewage. In recent years, however, activated-sludge treatment has continually won a place of greater importance, and a whole series of new activated-sludge plants has been constructed in the Republic.

Certainly the progress of the United States in this phase of sewage-treatment technique has contributed very much to this development. In this connection, processes developed only in the United States such as step aeration, modified aeration, activated aeration, biosorption and others, have strongly influenced our own endeavors in this field. In Germany, the high cost of energy, in contrast to the cost in the United States, and the increasing cost of loans has made it necessary to direct technical activity toward a goal of (a) better utilization of the structures involved, (b) a decrease in the size of the treatment facilities, and (c) an increase in the performance of sewage plants. The greater the size of the units, the less the constructon costs are, the greater is the unification that can be made; therefore, designing engineers, endeavor to keep the number of structures as few as possible.

Trickling Filters

Treatment with trickling filters receives a strong impulse in Germany, since the development of high-rate trickling filters of great depth and high loading was introduced 20 years ago. These high-rate trickling filters, which were built to a greater extent after the war, were computed by Imhoff so that the sewage from about 25 persons is discharged on 1.3 cu yd of filter medium (corresponding to 1.5 lb of 5-day BOD per cu yd per day). Formerly only 5 persons were served by low-rate filters — but at the same time the surface loading amounted to at least 20.5 mil gal per acre per day and more generally about 30.8 mil gal per acre per day.

Filter loadings today still amount to five times what was formerly customary. With a bed depth of from 9.8 to 13.1 ft it is necessary for two requirements to be met precisely for the proper functioning of high-rate trickling filters under German conditions. High-rate trickling filters can be satisfactorily loaded up to 2.5 lb of 5-day BOD per cu yd per day. Even at 100 per cent overload trickling filters at the treatment plants of the Ruhr District (Fig. 6) still show a BOD removal of more than 70 per cent and as a result produce an effluent having a 5-day BOD varying from 40 to 70 mg/L. Removals are correspondingly higher with lighter loadings.

In Germany trickling filters are built relatively deep in contrast with the United States and England. With a range in depth from 9.8 to 13.1 ft most trickling filters are from 11.5 to 13.1 ft deep. Deep filters are adopted in order to produce a good flushing effect with a surface loading of from 3.3 to 4.9 ft per hr and at the same time in order to purify a strong sewage. If for some reason a shallower bed must be constructed, the requirement for proper washing can be maintained by pumping back the effluent. Recently, proposals have to furnish an abnormally deep filter ranging from 26 to 30 ft deep, in lieu of recycling strong sewage to the filter.

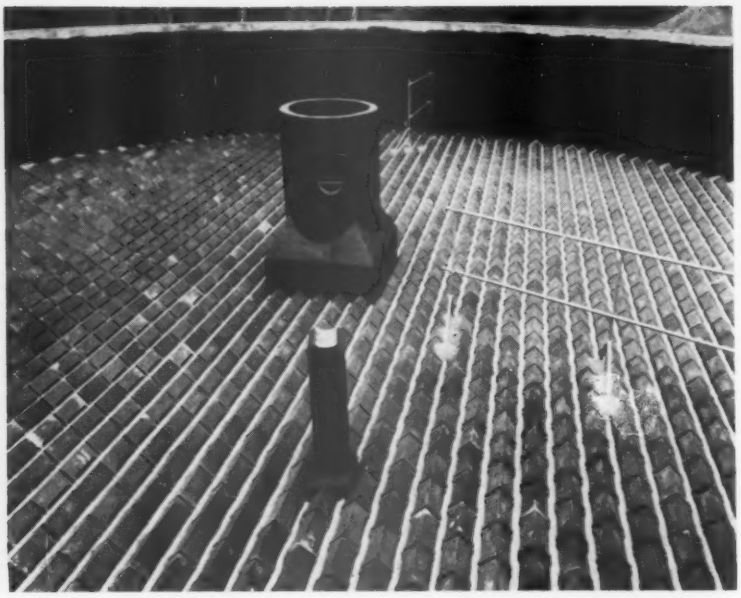


FIG. 6—TRICKLING filter floor, Hagen sewage-treatment plant, 76 ft in diameter x 12 ft deep. Floor, which is covered with triangular shaped stones, is also covered with roof shaped blocks, provided on each side with horizontal aerating slots. Sampling pipes can be seen in illustration. Distributing of sewage accomplished by rotary distributor.

The power demand for operating trickling filters amounts to about 9.15 to 11.5 watts per cu yd of filter material. Computed on the kilowatt hours per kilogram of 5-day BOD removed, the value of the required energy, resulting from operating experience, lies between 0.09 and 0.14 kw hr per lb.

The biological action taking place in trickling filters requires oxygen. A good aeration of the filter media is, therefore, very important. In addition to an appropriate choice of the size of the media — today generally from 1.6 to 2.4 in. — the formation of trickling-filter floors has special importance. In recent years very effective forms have been developed for the channel and bottom pieces, which have come into use. The Ruhr River Association uses in its plants, roof-shaped bottom pieces, which are equipped with horizontal aerating slits and are set on triangular-shaped bottom channels (see Fig. 6).

A group of trickling filters in the Ruhr, the Emscher and the Lippe Districts have been designed as covered, enclosed, aerated filters. In such cases artificial aeration of the filter is accomplished by blowing in air.

High-rate trickling filters are cheap to operate and from an economic standpoint are superior to all other biological purification facilities, if a 5-day BOD effluent of from 10 to 30 mg/L is satisfactory when sewage is treated, as for example is the case in the Rhine-Westphalia industrial district. In the case of very strong sewage one will maintain the 5-day BOD of the effluent between approximately 30 and 50 mg/L. This perhaps also may be the reason why high-rate trickling filters have not succeeded so well in other countries, as for example in England, as in Germany. There the authorities strive to maintain the 5-day BOD of effluents continually under 20 mg/L.

The principle of the operation of trickling filters remains essentially unchanged. The development in Germany, therefore, can naturally be concentrated only on technical and construction problems and on the improvement in efficiency.

Activated Sludge

It is only recently that activated-sludge plants have been built in Germany. This method of treatment, which was further skillfully developed in the meantime in the United States, also prevailed after the war in Germany. The Niers District augmented its large group of plants in Neersen, whereby a new kind of sewage conduit was employed. The water is conveyed in a channel, which lies in the longitudinal axis of a double basin and which extends three-fourths of the whole length of the basin. This channel has a notched overflow weir, which guarantees that the sewage is brought forward equally on the two lateral sides, is divided by channels, consisting of thin-metal plates with holes in them and from here is broken up into single streams and conveyed to the activated-sludge basin. By means of this arrangement the thick formation of foam in the aeration basins, which is traceable to the increasing use of synethic detergents, is prevented.

At another plant in the Niers District, the Dülken sewage-treatment works, the three purifications steps — the settling basin, biological treatment and secondary settling — are united (Fig. 7) in the form of a ring into one another in a radially undivided structure, through which the sewage flows radially. As a further example of a similar kind the combination tanks at Werl in the Lippe District should be mentioned.

In recent years the Ruhr River Association has built a group of high-rate activated-sludge plants, which are operated in general according to the step-aeration method, first introduced by Gould in the United States. These plants, as for example Brilon and Hemer, are operated as single or two-step biological treatment plants, in connection with which activated-sludge treatment is employed as the first step, as for example at Gevelsberg and Iserlohn or as the second step as at Neviges.

Where activated-sludge treatment is employed as a single-step process or as the first step of a two-step biological treatment plant, the Ruhr River Association renounces the insertion of a preliminary settling basin of conventional size; instead, the heavy suspended solids are retained in a tank, designed to remove the coarse sludge solids in a detention period of 20 to 30 minutes. In two-step biological treatment, where the first step employs trickling-filters, there is no sec-

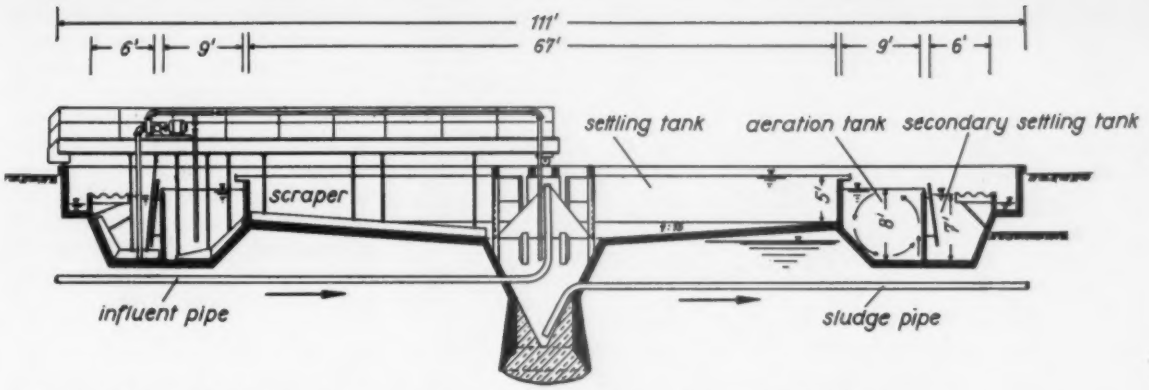


FIG. 7—COMBINATION settling and aeration tank, Dülken activated-sludge plant, Niers District.

ondary settling basin used for this first step.

The kind of aeration is of great importance for the technical and economical efficiency of an activated-sludge plant. Besides aeration with fine bubbles aeration, German practice also employs both medium and large-size bubbles, and mechanical means with brushes and rotating bars. Most of the medium and large size aeration tanks are of the spiral-flow type. Only the small plants use ridge-and-furrow tanks, in which case they are provided as a rule with perforated pipes made of synthetic materials with openings 0.06 to 0.12 in. wide for the transmission of the air. At the newest plants in the Ruhr District, for example at Essen-Werden and Gevelsberg, aeration is accomplished by the use of diffuser tubes (Fig. 8) which are arranged vertically in a longitudinal direction in the form of a broad aeration band.

At plants with a high proportion of industrial wastes, principally sewage from the metal industry, perforated aeration pipes with large holes and made of steel or synthetic material, as well as brushes or rotating metal lattice work, which operate at the surface of the sewage, are employed to an increasing degree of aeration. These systems of aeration are used instead of aeration by fine bubbles through diffuser plates or tubes.

In connection with the introduction of new methods of activated-sludge treatment, research relative to oxidation capacity produced by different means of aeration has won a place of great importance. For this reason experiments involving the entry of oxygen and the movement of water in aeration basins were carried out, in recent years, partly on a technical scale by the Ruhr River Association (Fig. 9) and in other places. These studies showed that aeration with small bubbles and aeration by means of rotating metal lattice work are most efficacious relative to oxygen absorption, and according to the size of the bubbles a utilization of oxygen of from 5 to 10 per cent can be obtained.

FIG. 8—AERATION TANK, Gevelsberg sewage plant, Ruhr District. Aeration by broad band of pipes, each 43 in. long x 3 in. in diameter. At top are tilted wooden panels. Steel channels, provided with clamps, span tank crossways, on which metal plates can be suspended and oscillated to produce cross walls when needed. It is possible in the middle and at both sides to alternately render the cross-section free for the unhindered flow of sewage and thus accomplish good mixing of tank contents.

In general, aeration basins are designed for shorter aeration periods in Germany than in the United States. Likewise the ratio of air to sewage is less. The aeration time of heavily loaded activated-sludge plants amounts in general to from 0.5 to 1.5 hours, in connection with which the ratio of air to sewage amounts to from 1 to 1 up to 3 to 1 during the day and about 1 to 1 at night. When calculated on the kilowatt hours used per kilogram of 5-day BOD removed, the energy demand according to operating results amounts to about 0.20 to 0.45 kw-hr per lb of 5-day BOD; the energy used at most plants is nearer the lower value.

The current consumption at plants provided with biological secondary treatment facilities averages 11.5 kw-hr per capita or 258 kw-hr per mil gal of sewage treated. About 0.5 man-hours per capita per year is required at small plants, serving up to 20,000 persons, and approximately 0.25 man-hours per capita per year at large plants. All figures relate to the actual number of persons served by the plant without considering the population equivalent of trade wastes. About 9.1 man-hours per mil gal per year of sewage treated are required.

Sludge Digestion

Although there is no revolutionary new information involving the nature of sludge digestion, nevertheless the advance that has been made brings essential improvements and refine-

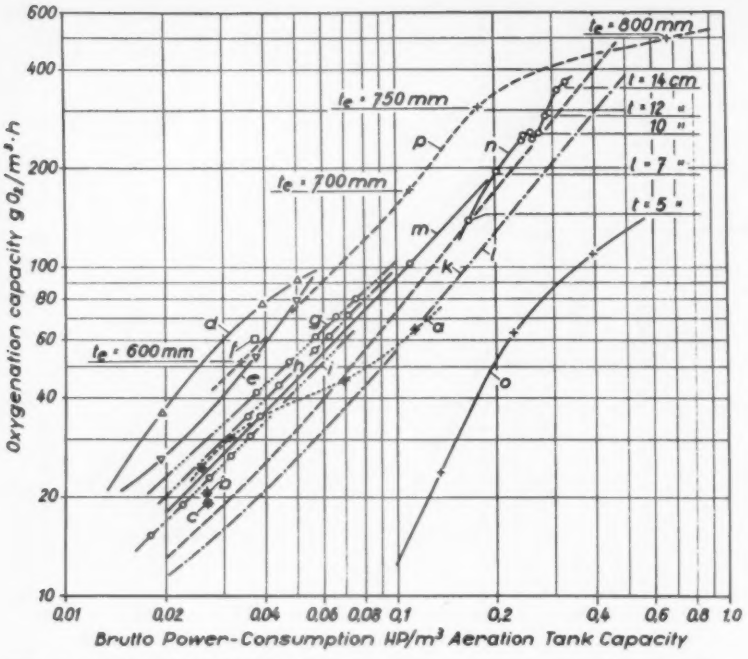

Oxygenation capacity g O_2/m³·h
Brutto Power-Consumption HP/m³ Aeration Tank Capacity
l_e = 800 mm
l_e = 750 mm
l_e = 700 mm
l_e = 600 mm
t = 14 cm
t = 12 "
10 "
t = 7 "
t = 5 "

FIG. 9—OXYGENATION CAPACITY in grams of O_2 per cu meter of tank capacity per hour and the necessary gross power consumption when related to tank capacity. For comparison, oxygenation capacity for other kinds of aeration are likewise given in the diagram.

a. Wickede sewage-treatment plant; depth of aerators: 6.6 ft. Aeration is through 0.079-in. holes in pipe, arranged in broad bands.
b. Same as above, but depth of aerators is 5.1 ft.
c. Same as above, but depth of aerators is 3.6 ft.
d. Gevelsberg sewage-treatment plant; depth of aerators: 13.1 ft. Aeration through diffuser tubes, 3.6 ft long x 0.28 in. in diameter with 190-280 μ pores.
e. Same as above, but with diffuser tubes having pores 290-400 μ.
f. Same as above, but an aerator depth of 12.2 ft and with diffuser tubes having pores 290-400 μ.
g. Wuppertal-Buchenhofen sewage-treatment plant. Aeration with large bubbles through an open pipe 1 in. in diameter.
h. Heilbronn sewage-treatment plant. Aeration with large bubbles.
i. Baden-Baden sewage-treatment plant. Aeration with large bubbles.
k. Aeration with large bubbles, great depth of aerators.
l. Aeration with large bubbles; shallow depth of aerators.
m. Kessener brushes.
n. Kessener brushes in small tanks without hood.
o. Pista aerator.
p. INKA low-head aeration system.

ments in the technical sphere of sludge decomposition as well as sludge handling and sludge utilization.

For the loading of digesters that are covered and heated, Imhoff gives a value of about 0.12 lb of total solids per cubic foot per day at a temperature of from 77° to 86°. Since the change to higher temperatures in digesters, a greater loading of from 0.19 to 0.31 lb of solids or 0.13 to 0.22 lb of organic solids per cubic foot per day has been used. In connection with the digestion of strong sewage sludge (Fig. 10) as well as certain kinds of industrial wastes, for example brewers' waste from a yeast factory, strawboard waste and others, successful loadings up to 0.31 to 0.37 lb per cu ft per day have been used.

Sludge digestion, as practiced today in Germany is mostly at higher temperatures. Temperatures are generally from 86° to 95°F whereas they formerly were from about 81°F.

Sludge inoculation and sludge circulation is especially important for the digestion process. The entering fresh sludge is brought into intimate contact with the digested sludge by means of circulating pumps, which are either inside the tank, as for example screw mixers, or on the outside. Frequently, however, the inoculation of the fresh sludge takes place outside the digester. In many cases, fresh sludge is spilled over the exposed surface of the sludge in the digester through rotating trays, s-shaped pipes, hoses and the like, or a stream of fresh sludge is expelled on one or several limited places on the upper surface of the sludge.

Scum Control

An effective control of scum is important for the regular operation of digesters, inasmuch as the space occupied by scum diminishes the effective digestion capacity. Screw mixers are advantageous for the assured overturning of the scum and the circulation of the contents, especially in the case of large digesters. The sludge is propelled by the screw mixers from the bottom to the top and sprayed on the surface, by which means the scum is destroyed and the tank contents are circulated. By reversing the direction of the screw the scum at the top is sucked down into the sludge so that the scum, which otherwise is very difficult to decompose, is digested. In order to be able to control the formation of scum better and to destroy it better, an endeavor is made in Germany to keep the upper surface of the sludge in digesters as small as possible by giving the upper part of the digester the form of a obtuse cone, which is provided in many cases with a cylindrical neck. The surface of the scum is in this neck.

The digested and thickened sludge is drawn from the bottom of the digester. On account of the proportionately less sliding facility of the sludge the walls of the lower part have a rather steep slope. A slope of 1 to 1 has been proven to be satisfactory. By controlling the design, the aim also is to maintain the heat loss through radiation as low as possible. In Germany, this fact has led to a cone-shaped form, since the cone has the smallest upper surface for the same volume and at the same time the least heat loss. With respect to the choice of tank dimensions, designing engineers endeavor to make the ratio of surface to volume a minimum.

At the larger treatment plants, two-stage digestion tanks are coming into

use more than ever, whereby the second step, according to local conditions, is smaller or larger than the first step. The secondary digesters are larger, especially when they are made, for example, of earth, which under the circumstances serve at the same time for sludge storage. The digesters of the first and the second steps are united by an amply large pipe at about the elevation of the supernatant sludge liquor zone so that they function as one communicating receptacle. To this pipe there is also joined a pipe, which reaches to the bottom of the first digester in order to allow the bottom sludge to overflow from the first tank into the second one when necessary. In general, the heating of the second stage results from the heated sludge which overflows from the first-stage digester.

Formerly, the heating of digesters, was principally by circulation of water at a temperature of about 140° F through a system of fixed or movable pipe coils. In recent years a number of other heating facilities have come into use. These are:

1. Blowing low-pressure (7.4 lb per sq in.) or high-pressure steam (29 to 118 lb per sq in.) into the sludge, whereby in the latter case, the sludge can be circulated at the same time by the use of an injector.

2. Heating the sludge by warm water or steam in a heat exchanger, situated outside the digester.

3. Heating the digester by a double-walled hot cylinder, set in the middle thereof, which is provided with warm water from a boiler located outside the digester in accordance with the principle of warm water gravity heating.

According to more recent tests and according to the size of the plant, mechanically operated sewage-treatment plants needs from 31 to 45 per cent of the gas developed to heat the digesters, for normally insulated tanks (9.2 Btu per sq ft per hr). In this connection, 31 to 35 per cent of the gas produced is used for large digesters (53,000 to 353,000 cu ft of gas production per day) and 35 to 45 per cent for small digesters (under 53,000 cu ft total capacity and 53,000 cu ft of gas production per day). With very well insulated digesters (4.6 Btu per sq ft per hr) this value is reduced to 29-31 per cent for large digesters and 31-36 per cent for small digesters.

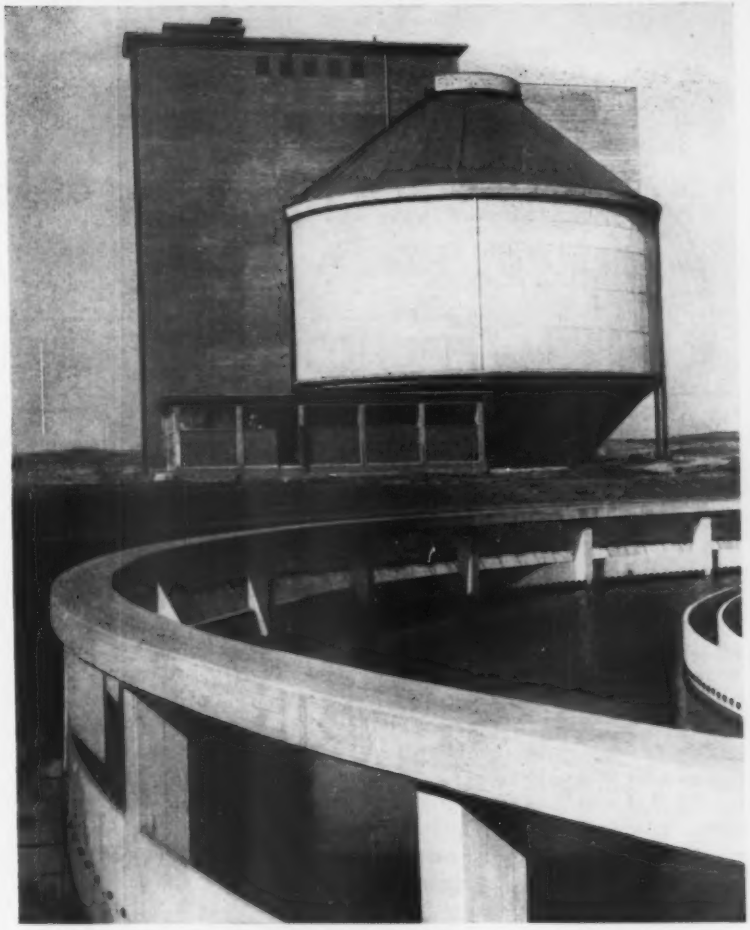


FIG. 10—DIGESTER, Duisburg sewage-treatment works, Ruhr District; capacity: 259,000 cu ft. As digester is situated where there are mines causing settling, foundation surfaces must be made as small as possible in order to obtain high pressure on ground. In foreground there is one of the settling tanks with diameter of 168 ft and with supplementary effluent channel (at right edge of figure). In rainy weather surface of sewage backs up and consequently detention period in settling tank is increased. To obtain this condition round openings for the influent and the effluent must be provided at height of normal dry weather surface of sewage. In rainy weather water falls over upper edge of channel walls.

At activated-sludge plants more heat is needed, because more digestion space is required and more fresh sludge needs to be heated. In general, for large digesters 37 to 40 per cent is needed for heating purposes and for smaller digesters from 47 to 59 per cent according to the size of the plant and the heat insulation provided.

The larger digesters are built today throughout in conformity to prestressed concrete procedure; in most cases, only the cylindrical part of the tank is prestressed in the circular and middle part, but in some cases, the upper truncated cone section is also prestressed. With this system, a free standing cylindrical shell is framed more or less along the lower edge of the digester, on the upper part of which is placed a cone-shaped shell.

Some digesters, in recent years, as for example in Frankfort and Bielefeld, have been built lemon-shaped (Fig. 11), for technical reasons, out of pre-stressed concrete. The ascending vault-like walls were built of concrete and split up into eight individual partitions. At the same time the supporting frame of the inner shell is at times turned further about ⅛ of the circumference.

In Germany, designing engineers endeavor to maintain the interior of a

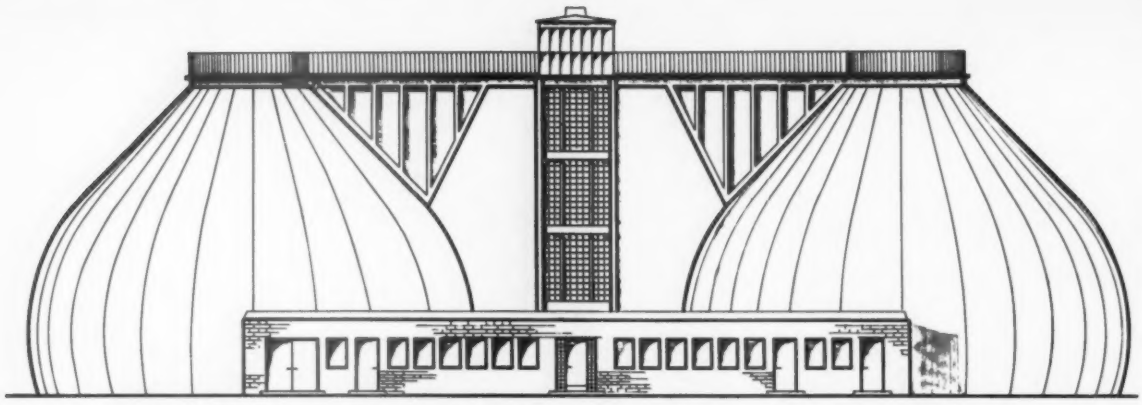


FIG. 11—DIGESTER, Bielefeld sewage-treatment plant. Both of these digesters, which are made of prestressed concrete, are lemon shaped and are built according to technical principles. Contents of each is 113,000 cu ft.

digester as free as possible of structures, pipes, sludge scrapers and the like. For this reason the bottom of the tank is given such a slope that the sludge slides of itself to the sludge draw-off pipe and a scraper is not necessary. For the same reason the surface of the sludge is kept as small as possible in order that it is not necessary to use scraperlike devices to destroy the scum. Only in the smaller digesters are devices installed for heating the sludge in the digester; in the case of all larger digesters this practice is avoided by employing exterior heat exchangers or by blowing steam into the sludge.

Sludge Dewatering and Drying

The sludge problem is gaining a continually greater importance in Germany. The administrative water districts of the Rhine-Westphalian industrial territory and also the large cities, as for example Hamburg, have occupied themselves intensively with these problems in the last decade. Arrangements for artifical sludge drying exist, but in contrast to the practice in America, only in small plants, as for example Hamburg and Neersen as well as Dülken in the Nier District. The digested sludge is dewatered there by a vacuum drum filter to a water content of about 70 per cent (the filter output is about 4.1 lb per sq ft per hr) and by a rotary heat drier to a water content of about 30 to 35 per cent, in connection with which about 1800 Btu must be expended for one pound of water that is removed during heat drying.

In the effluent from vacuum filters there is only a small quantity of the wet sludge suspended solids — about 5 per cent — which settles quickly so that it can be introduced into the influent to the treatment plant without further concern. To make the sludge more easily filterable, from 0.062 to 0.083 lb of $FeSO_4 \cdot 7H_2O$ per gal and from 0.13 to 0.17 lb of $Ca(OH)_2$ per gal is added to the digested sludge before filtering.

The machine industry has recently taken up again the problem of sludge dewatering by centrifuges. However, this machine is still in the experimental stage so that it would be premature to report on it here. With regard to machines for thickening sludge, in particular sludge dewatering, which work on the dynamic principle, as for example whirling screens, cone-shaped filtering machines and the like, nothing can be definitely stated. Up till now it has turned out in the case of the experiment conducted by the city of Hamburg that the holding back effect of a pressed filter cake causes the vibration treatment to fail. Likewise the fine particles go through very fine mesh screens into the filtrate, which moreover form a kind of emulsion. The question of the preparation of the filtrate is still not resolved. The filtrate with its proportionately high content of suspended solids in a finely divided form portends a higher loading for biological secondary treatment.

Conclusion

In conclusion, it can be said that in the last decade in Germany as in all the industrial countries of the world, activity has been very marked in the sphere of sewage treatment. But it still demands greater efforts to take care of the ever increasing load on watercourses, because the tempo of the expansion of industrial production and the growth of cities is extraordinarily great.

The German technique relating to sewage treatment is very much indebted to the scientific studies emanating from America. Perhaps in no country in the world has so much been done in this sphere as in the United States. There is a zealous activity there for research as the writer can vouch for from his own observation during an inspection trip, opportunely made to the United States in the fall of 1955.

Almost all the universities in the United States have laboratories and schools in which the students can work in a practical way on problems relating to sewage and likewise where the professors and assistants work on research problems.

Moreover there are large, independent institutions in existence — the Robt. A. Taft Sanitary Engineering Center in Cincinnati, Ohio, the Mellon Institute in Pittsburgh, Pa., and the Experiment Station in Lawrence, Mass. — which engage in research and development work in this sphere of activity.

In this connection, a beginning has been made for the first time in Germany by the establishment of an Institute of this kind at the Stuttgart Technical University. There remains much to do here for us Germans, and as to this we can learn much from Americans. At the same time the American technical schools very happily prepare publications and are gladly ready to share their experience and knowledge with others.

"Sick Digesters" may result from an incomplete understanding of the . . . .

Elements of Sludge Digestion

by A. PAUL TROEMPER,
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EDITOR'S NOTE: The material presented in this article was collected for use in lecturing to a short course for sewage treatment works operators. There is no attempt here to present any new or original ideas, but rather to set down in as clear and understandable a form as posible, material obtained from a number of sources concerning commonly accepted and proven practice. It is hoped that the content of this article may be of help to the new or less experienced treatment works operator, for whom it was particularly written.

■ A CLEAR UNDERSTANDING of any process operation must be preceded by an understanding of why the process is necessary or what it accomplishes. Since sludge digestion is merely one of the several process operations comprising the overall process of sewage treatment, it is therefore appropriate to begin by listing the principal reasons for sludge digestion. They are:

1. To produce an inoffensive sludge for disposal.

2. To reduce the amount of sludge to be handled for disposal.

3. To produce a sludge which will dry readily.

In addition to the above reasons for sludge digestion there are several more reasons, which are normally not applicable but, which might sometimes apply. They are: 1. To produce a sewage sludge gas and 2. To produce a sludge usable as a soil conditioner.

How is Sludge Digested?

The sludge digester is a structure that provides the medium for the existence of a veritable world unto itself. The tank contents are a living thing. It is inhabited by billions upon billions of organisms (bacteria and other micro-organisms) of many different types. Products produced by one group are consumed as food by other groups. New organisms are continuously being produced, and others are being consumed as food by still other organisms. These activities are all going on in the digester at the same time and continue until most of the bacterially edible elements have been consumed and the digester contents have become stable.

These organisms use the sludge as food and in so doing break down the organic matter which would have caused it to purify. The digestion process produces an inoffensive sludge for ultimate disposal. The organisms also cause certain of the solids in sludge to become liquid, some to become burnable gas, and change other of the solids so they will compact more readily and thus reduce the volume of the sludge to be disposed of. Organisms present also break down the water binding properties of the sludge to produce a sludge that will dry readily.

When sewage solids are added to this process, they pass through three stages:

1. Acidification—A period of intensive acid production.

2. Liquefaction—A period of acid digestion.

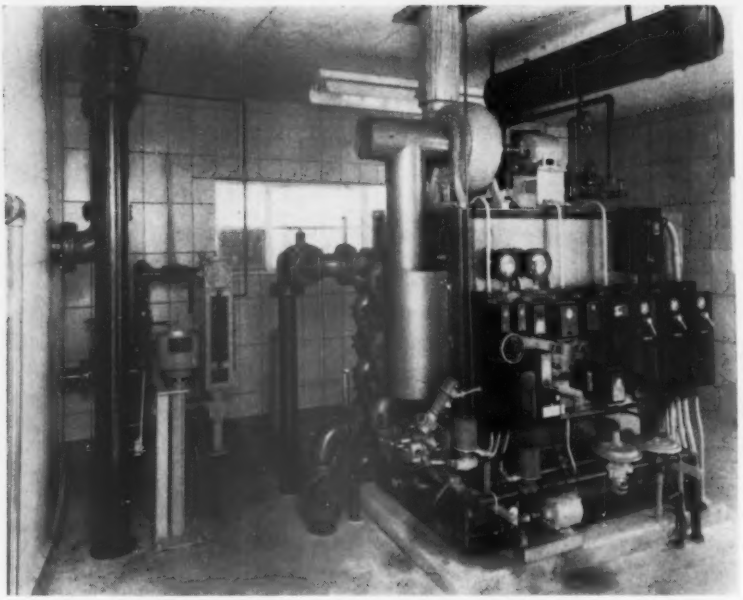
3. Gasification—A period of intensive digestion and stabilization.

A fourth period of humification then occurs, where gas production decreases, and an increase in pH, solids concentration and further breaking down of the organic solids takes place. Actually in a properly operating digester all of these periods of digestion are taking place at the same time, unless the process is divided into several stages using several tanks.

The digestion process is a continuous one—fresh sewage solids being added at frequent intervals and digested material being removed at less frequent intervals; the digester liquor (supernatant), the product of the liquefaction and mechanical separation of the sludge and the water, being removed frequently; and the gas being removed continuously. The job of the plant operator is to balance the operation of the digestion system so that the most beneficial results are obtained. The best overall results from the digestion system will be obtained when the third period of intensive digestion and stabilization (gasification) predominates. When the first two periods predominate the digester is tending to become overloaded, and trouble is in the offing.

How is Sludge Digestion Controlled?

Before answering this question it is well to see what factors effecting



EXTERNAL HEAT EXCHANGER installed at Morris, Illinois is rated at 250,000 BTU/hr.

sludge digestion can be controlled. They are essentially:

1. Seeding.
2. Temperature.
3. Reaction.

Seeding

The seeding or mixing of the raw sewage solids with well digested sludge is probably the most important single factor in digestion control. The "ripe" or well digested sludge contains the organisms and their products needed for rapid digestion, provides a balanced environment for the organisms, and contains materials (buffers) which counteract the effect of other products formed in the early stages of digestion. The total quantity of gas is not influenced by seeding, but the rate of gas production is changed. Sludge digested without seeding takes four to six times longer for digestion than seeded sludge. If a new digestion tank is placed into operation or an existing tank is emptied, it is advisable to seed the tank with digested sludge to provide these organisms and their products. In drawing sludge to the beds, it is important not to draw too much at one time or the seed might be lost and consequent difficulties ensue.

Summarizing a discussion on seeding to a few words — it might be said that good mixing of fresh sludge with seed (digested sludge) is necessary to good digester operation. A certain amount of mixing is done naturally by the rising gas; however, this normally is not enough. Provision has been made in many digesters for mechanical mixing by the use of mechanical stirrers or recirculation pumps to provide this good mixing of the fresh sludge with the seed. Within the past several years recirculation of gas (blowing the digester gas through the sludge) to effect mixing has come into use with quite effective results. Several processes are available employing this principle in one form or another.

Temperature

The second item which can be controlled is the affect of temperature on digester operation. Since the living organisms accomplish the digestion process, it is obvious that it will proceed, most rapidly at the temperature best suited to the organisms. The methane producing organisms thrive best between 85° and 95°F. The time required for digestion decreases with higher temperature. To illustrate this: Between 90° to 100° F well digested sludge is produced in about 24 days; at 85°F 90 per cent of digestion is completed in 26 days; at 75°F, 35 days; and at 55°F, 55 days. The high temperatures are most difficult to maintain and require considerable heat transfer, especially in colder climates. However, the most desirable operating range is considered to be between 90° and 100° F.

While the total amount of gas produced at the higher temperatures of the digestion range is not appreciably different from the amount produced at lower temperatures, the gas is produced in a shorter time at the higher temperatures. Under normal conditions about 1 cu ft of gas per capita per day can be expected from the digestion of domestic sewage solids. The presence of industrial wastes in the sewage may vary this amount either up or down, depending on the type of wastes. Wastes high in organic solids will increase gas production. Other wastes such as those containing copper, may reduce gas production.

The organisms responsible for the digestion process, in addition to requiring a certain temperature range for optimum growth, are affected by small temperature changes so that rapid changes either up or down produce detrimental effects on the digestion process. Summarizing the subject of effects of temperature, it might be stated that for best digester operation: Temperature should be maintained between 90° and 100°F, but regardless of the temperature selected in this range it must be maintained at that temperature within a narrow range of 2° to 3°F. This is done by an adequate digester heating system and satisfactory temperature controls, by insulating the digester walls by means of earthen embankments, etc., and by keeping the digester contents mixed so that there will not be temperature stratification (layers of sludge or scum of different temperatures) of the digester contents.

Reaction

The third factor that affects digestion is reaction. The organisms responsible for the digestion process require an environment which is about neutral. In general, the pH of the digester contents should be about 6.8 to 7.2. Ordinarily, in a well designed and operating digester, it is possible to maintain a balance between fresh and digesting solids so that the reaction will remain within these favor-

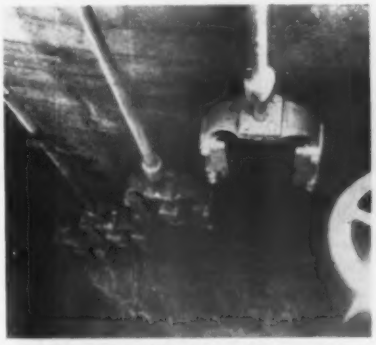
able pH limits. The material in the third period of digestion (intensive digestion and stabilization) tends to provide a buffering action (cushioning effect against change in pH). However, an insufficient amount of seed or low temperatures may retard the intensive digestion and stabilization taking place in this third period, and cause an accumulation of the acid products formed in the first stage which will overcome the effect of the buffering. When this happens the pH and alkalinity of the tank contents will drop, gas production will drop and foaming will probably occur. The volatile acids test will forewarn of such conditions, if this test is run routinely. In a normally operating digester the volatile acids should be in the range of 800 to 1000 mg/L and should not exceed 2000 mg/L. A steadily increasing volatile acids concentration up to and exceeding this upper limit is an indication that an upset is in the offing even though there may be no noticeable change in the pH. Corrective action, such as adjustment of temperature, seeding, or loading of the digester is then called for.

If difficulties are being experienced with digester upset, what can be done about them? Some operators say adding lime to the digester will correct it. Others say that lime has no place in a digester. Regardless of this difference of opinion it would seem reasonable in any event to correct the conditions which might have been responsible for the upset. If temperatures are considerably below the desirable range, they should be raised if possible. If the temperature is not abnormal, the chances are that seeding has caused the trouble. If this is suspected, reducing the raw solids loading to the digester may help; or recirculation of material containing the desired seed material from a second-stage digester to the primary digester may also help. If these do not corect the condition, chances are that the digester is overloaded. If overloading of the digester is the cause of the trouble, about the only solution is to provide additional digester capacity. Heated digesters handling only primary sludge should have 2 to 3 cu ft of capacity per capita; those handling primary and trickling filter sludge 3 to 5 cu ft per capita; and those handling primary and activated sludge 4 to 6 cu ft per capita. Unheated digesters should have double these values.

Controlling Sludge Digestion

Sludge Addition

In pumping sludge to fixed cover digesters, the sludge should be added at frequent intervals and at a low rate to minimize disturbing the supernatant which is discharged from the digester at the same rate as the sludge is added. However, sludge should be added as often as practical regardless of type of digester. The addition of smaller quantities at frequent intervals assures a more constant food supply to the organisms and a more uniform digestion rate. Sludge should be pumped as often as practical but at least twice a day for the smallest plants.



DRAWOFF VALVES for digester supernatant at Springfield, Ill.

In pumping sludge to the digesters, only the sludge should be pumped and not large amounts of sewage as well. It must be considered that raw sludge from the primary tank normally contains 2 to 6 per cent solids, thus the great bulk of digester contents is water even under the most favorable conditions. Pumping large amounts of sewage with the sludge adds needless water to the digester which serves no purpose, makes digester heating more difficult and reduces the retention time in the digester. It is also advisable not to pump sand or cinders to the digester if it can be avoided, since they would occupy space in the digester which would otherwise be available for digestion.

Temperature Control

If the digester is equipped with heating coils, it is advisable to hold the water temperature in the coils no higher than 130°F. If it is possible to get by with a lower temperature than this and still maintain the desirable temperature of digester contents at 85° to 95°F, it should certainly be done. If temperatures in the coils are allowed to go above 140°F, an insulating layer of sludge is likely to cake on the coils, thereby making digester heating more difficult.

The temperature of the digester contents should be determined at least once per week. The approximate temperature can be obtained by checking the supernatant, but thermometer wells installed in the digester are more accurate. It is important for Digester temperature to be maintained within a range of 2° to 3°F.

If considerable quantities of greases must be handled in the digester, better results might be obtained at temperatures between 95° and 100°F.

Supernatant Withdraw and Disposal

Before discussing withdrawal of supernatant, it might be well to point out why it is done. Supernatant is withdrawn to provide additional storage space in the digester without increasing heating requirements. The supernatant withdrawn from the digester should be that with the lowest possible solids concentration. The supernatant should be drawn slowly over as long a period as may be practical. If fixed supernatant withdrawal levels are provided, each dawoff level should be sampled daily and supernatant should be drawn from the clearest drawoff.

With fixed cover digesters the supernatant is generally withdrawn at the same rate that the raw sludge is added. Sludge should therefore be pumped for short periods at frequent intervals to prevent the discharge of large volumes of supernatant in a short period of time. Care must be taken to keep the supernatant outlet clear. If this is not done pumping of sludge to the digester can raise or crack the cover.

With floating cover digesters it is not necessary to exercise as much caution as with fixed covers; however, supernatant should still be drawn slowly over as long a period as may

FLOATING COVERS at Cincinnati, Ohio plant are a Pacific Flush Tank Co. product.

be practical. Supernatant may not be withdrawn from a floating cover digester at the same time raw sludge is pumped to it. Where external heating and recirculation of digester contents is provided, it is advisable to discontinue recirculation for a period of several hours before drawing supernatant, in order to allow separation of the supernatant and the rest of the digester contents.

Supernatant is normally disposed of to the primary settling tank, sludge beds or to a lagoon. Difficulties have been experienced in some instances by supernatant causing the primary tank to become septic; therefore disposal to sludge beds or lagoons has been practiced. When using sludge beds, as little area of the bed as practical should be used, and the dried cake should be removed from the bed frequently. The location of lagoons used for supernatant disposal should be carefully selected. Provision of a lagoon of sufficient size will minimize possibilities of odors. When lagoons are used, they may be designed for returning the clear liquor to the treatment process.

Some plants have found it advantageous to discharge supernatant directly to the aeration tanks or trickling filters. A patented process has recently been developed utilizing the supernatant liquor to advantage in controlling the activated sludge and trickling filter processes.

Withdrawal and Disposal of Digested Sludge

The type of digester, sludge drying facilities, and the season of the year, normally govern the withdrawal of digested sludge. It is important in all instances to leave enough digested sludge in the tank to seed the raw sludge and to maintain a balanced alkaline digestion. In heated tanks the amount of sludge left for seed may be the same regardless of the season of the year. In unheated tanks the same amount as in heated tanks can be left for seed in the summer, but in cold weather at least twice as much must be left for seed. Under normal conditions at most plants it is desirable to leave at least 4 ft of digested sludge above the hopper. There need be little fear of carrying the sludge level high in the digester unless it interferes with the quality of the supernatant. Where possible in small plants, sludge should be drawn in small amounts filling only one bed at a time at about monthly intervals. Some operators have made the mistake of withdrawing large quantities of digested sludge from the tank when confronted with a digester loaded with solids, containing little supernatant liquor and having a heavy scum or floating sludge layer on top. This generally aggravates the condition by upsetting the alkaline digestion balance, and results in an increased floating sludge layer.

Only well digested sludge should be withdrawn from the tank. Such sludge is granular in appearance, dark in color and has a tarry odor. Gray or light brown streaks in the sludge are signs of undigested material. Sludge withdrawals should not be made from floating cover digesters if the cover is in a low position on or near the landing brackets because air may be drawn into the tank. When withdrawing sludge from a fixed cover digester, the raw sludge pumps should pump sludge or sewage to the tank at a rate at least as great as the digested sludge is withdrawn, or air may be pulled into the tank. Air drawn into a digester and mixed with digester gas produces an explosive mixture.

Starting Digester Operation

When starting up a new digester or one that has been emptied for repairs, the following precautions should be observed: The tank should be carefully inspected while empty, (be sure to ventilate the digester thoroughly before entering), all debris removed, and the valves, stirring mechanism and any other interior mechanism checked for proper operation. The pressure vacuum relief on the cover should be adjusted and all piping checked to be sure it is tight and free of obstructions.

Fixed cover digesters should be completely filled with sewage or water to eliminate an air accumulation beneath the cover, and thus reduce the explosion hazard. On floating covers the handhole in the gas dome should be opened and the tank filled enough to lift the floating cover from the landing brackets. Uncovered digesters can be filled with sludge as it accumulates.

The digester should be seeded with partially or well digested sludge if possible. The seed sludge should contain twenty times the weight of dry solids as may be anticipated in the daily production of raw sludge. However, it may be impractical to do this if a source of seed sludge is not readily available.

On heated digesters the temperature should be brought up to 85° to 95°F using bottled gas, etc. before any sludge is added. A temporary gas connection and adjustment or replacement of the gas burner orifices may be necessary to do this. Grease from

skimmings should not be transferred to a new digester until it is operating normally.

Scum Control

Excessive scum should not be allowed to accumulate in a digester. In general, the scum layer should not be allowed to build up to more than 24 inches in thickness. It should be moist to allow the release of gas. Excessive scum can usually be prevented by the following procedures:

1. Submerge the solids which tend to float. This will keep the floating scum moist so that the solids will digest.

2. Circulate the supernatant to wet down the scum with a liquor containing seed organisms. This will help to disperse the scum and also cause it to digest more rapidly.

3. Add ammonium sulfate in small quantities and circulate into the scum zone. This has reportedly been quite helpful in dissipating excessive scum layers. However, caution should be observed in the operating procedures used, since it is possible to bring this scum into active digestion too rapidly and thus cause foaming.

4. Install newly developed methods of gas recirculation for mixing in digesters. The method appears to be extremely effective in controlling scum and is probably the best means of control available at the present time.

Foaming

Foaming usually results from an overactive tank where solids after having accumulated without digestion, have all started digesting at one time. A typical example of this is when a cold digester full of solids is heated for the first time. The best remedy is to reduce the raw solids loading to the digester and to maintain the digester temperature at the desirable level. This will allow the digestion of the solids already in the tank and the foaming will subside. When the foaming stops, the full raw solids load can then be placed back on the digester.

Two-Stage Digester Operation

Two-stage digestion uses two compartments or two tanks and separates the violent initial digestion period from the slower final one. Under Normal operations the periods of intensive acid production (acidification), acid digestion (liquefaction), and intensive digestion and stabilization (gasification) are contained in the initial or primary digester. The fourth period of humification generally occurs in the secondary digester.

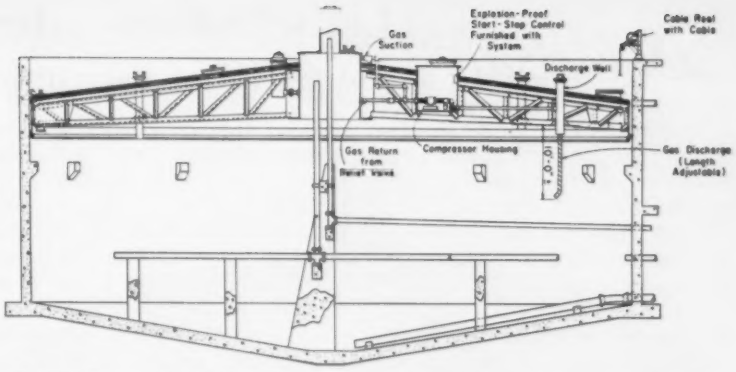
In the primary digester, incoming raw sludge is well mixed with seeding material. The tank contents are kept well mixed by use of mechanical stirrers, sludge recirculation or gas recirculation. Some sludge separation normally occurs in spite of the mixing and the heavier material settles to the bottom of the tank.

The digestion process is completed in the secondary tank. Here the lower gas production causes less mixing, thus allowing sludge separation and the formation of a much clearer supernatant than can be produced in a single stage digester.

Fixed Cover Primary Digester

The supernatant or lighter sludge is normally transferred to the secondary digester while raw sludge is being pumped to the primary digester. The supernatant and digested sludge is withdrawn from the secondary digester in the same manner as it is done with a single digester.

If the primary digester tends to become upset and the pH drops, sludge may be pumped from the bottom of the secondary digester to the primary to provide additional seed and to maintain alkaline digestion. Supernatant must be transferred from the primary to the secondary digester simultaneously.



PEARTH Gas recirculation system is a method of mixing digester contents.

The temperature in the secondary digester is normally maintained 5° to 10°F below that of the primary digester to improve supernatant separation. Under normal conditions this makes heating of the secondary digester unnecessary except during the coldest part of the year. However, if complete digestion is not being obtained, the temperature should be increased to 90° or 95°F.

Floating Cover Digester

A floating cover primary digester may be operated in the same manner as the fixed cover type where new sludge pumping automatically forces supernatant or light-sludge through the overflow piping to the secondary. As an alternate the sludge transfer may be made every two or three days. In other respects operation is similar to that with a fixed cover primary digester.

Pickups from Purdue's Sanitary Engineering News

The Heymann sludge thickening process which uses a vibrating screen and rotary filter press, was developed in Germany in 1954. It presents a new concept in mechanical sludge drying. This process, recently patented in the United States, has been installed in more than twenty sewage treatment plants in Germany and Switzerland.

* * *

Equivalent population based on sewage received at the Miami, Florida plant was 155,000 for January. Census says 1950 population was 249,276. Draw your own conclusions.

Dear Bill:

Let's institute demand charges, and get rid of water using "free-loaders".

Your letter asking for my thoughts on the principle of demand charges relative to their application to water service received. You have laid yourself wide open for me to unburden my mind as this is a subject that is of great interest to me.

The water supply industry is a conservative one and I think often suffers because of that fact. It is my thought that this conservative attitude is behind the by-passing of the application of demand charges in the industry and it is time that everyone take stock of the fact that such a charge is just as sound in meeting the cost of water service as it is in electrical service. Demand charges are used, and have been used by the electrical industry for many years as the only non-discriminatory basis of allocating the cost of service on the basis of the individual customer's needs.

You may ask why demand charges, we have gone along for years on a step rate schedule? I think first, one must do some soul-searching and after that determine how you should correct old wrongs. I am sure your soul-search will disclose that you have several classes of water users that demand large quantities of water for short periods. These periods may vary from a few increments of time each day to seasonal periods. You must provide adequate source of supply, treatment, storage, high-duty pumping capacity and adequate distribution to take care of these peak demands. This requires a large investment in physical plant that lies idle in anticipation of these peak demands. Who is paying carrying charges on this investment when it is not in use under the usual water rate schedules? The answer is all users of the service. In fact the user that places no abnormal demand on the water facilities is subsidizing those that through their unusual demand necessitate the installation of this excess plant. Those creating these demands are the ones that should be paying these excess carrying charges and not have such costs spread across the board to all customers of the utility. The equitable way to accomplish this end is through the use of demand charges. It is interesting how a user under a demand charge will adjust his operations at no sacrifice to his needs to reduce the amount of the demand charge. With the rapid increase in the need for more and more water, this one result is one of no small importance to the water utility, particularly those in search of ways to augment their source of supply. Such adjustments to reduce peak demands are almost always possible. Like one water utility I know that paid for elevated storage in two years through reduction in maximum demand for electricity.

How should demand charges be set up? There are many types of demands that should be studied and to cover them all would require a letter of such length that I am afraid you would tire reading it, and to attempt to cover all classes of use that should come under demand charges, I am sure I would leave out many that should be considered. It is just impossible for one person to visualize all the uses that should be placed on a demand charge basis at the many water utilities throughout the country but to cover them all I will break them down into two general classifications, seasonal peak demands and, for want of a better term, regular peak demands.

Under seasonal peak demands I would include non-conserved water use in air conditioning, canning plants that operate only during the season when the fruit, berries, or vegetables ripen, seasonal golf courses, etc., etc. These I believe can be handled easiest from the standpoint of the utility and in understanding by the customer by charging a demand charge, or surcharge if you prefer, on the basis of the water not used when the operation is not functioning. You might say that as far as revenue is concerned this places such usage on a 100% load factor basis. Nothing could be more desirable from the utility's standpoint, and if I may dare say so what is desirable from the utility's standpoint is desirable also from the standpoint of all of the customers of the utility.

The other user that should come under the demand charge is the one that creates regular peak demands. This covers such a multitude of commercial and industrial users that I do not dare even cite an example. To determine the maximum demand of this type of user I believe we will have to fall back onto a demand meter. Unfortunately no manufacturer has seen fit so far to develop such a meter. They would, I am sure, if they were assured that they would be adopted by our industry. It just costs too much to do the research and development of such a meter and then to have to find a place for it on the shelf to store it.

Just for fun, let us assume we have such a meter, how would we use it? What the utility is striving for is a good load factor and if not obtainable then the customer should pay for any deficiency. So I would suggest that we like the electric utilties, bill the customer a demand charge according to the demand meter plus a usage charge. This could be it, or it could be expanded giving the customer a discount based upon his load factor. The better the load factor the higher the discount. This would have to be carefully worked out so that at maximum discount his final bill would be no smaller than if he used the same quantity of water under the regular rate schedule. A little arithmetic would solve this problem.

There might be some users where it would be impossible to determine the proper demand charge except on an annual basis. The Wisconsin Commission, I believe it was, handed down an interesting decision in this respect in a case of an electric utility. In effect they said that the usage should be billed for at the regular billing time and payments received were to be considered as payments on account. At the end of the year when the demand charge could be determined, the customer was to be so billed and when paid, the account would be closed for the year.

I am afraid this has been rather long, but I feel there is so much more that could be said on the subject. I am sure if I don't quit now, I would go on and on. Yes, you laid yourself wide open.

Yours, Cliff

"from Chicago"

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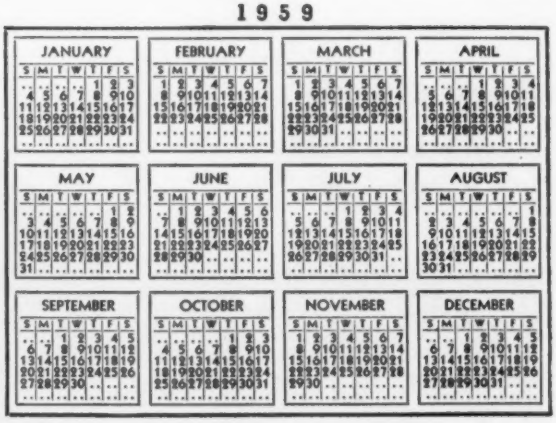
HOOKER CHEMICALS PLASTICS

Meetings

1959



May 11-13—Bay City, Mich. (*Wenonah Hotel*)
MICHIGAN SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Donald M. Pierce, Mich. Dept. of Health, Lansing 4, Mich.

May 13-14—Durham N. H. (*Univ. of N. H.*)
NEW ENGLAND SEWAGE & INDUSTRIAL WASTES ASSN., Spring Meeting, Secy., Earl R. Howard, Bur. of Pub. Works, 115 Broad St., Hartford, Conn.

May 21—Manchester, N. H.
NEW ENGLAND WATER WORKS ASSN., Secy., Joseph C. Knox, 73 Tremont St., Boston, Mass.

June 3-5—Ocean City, Md. (*Commander Hotel*)
MARYLAND-DELAWARE WATER & SEWAGE ASSN., Secy., W. M. Bingley, 2411 N. Charles St., Baltimore 18, Md.

June 3-5—Wernersville, Pa. (*Galen Hall*)
PENNSYLVANIA SECTION, A.W.W.A., Secy., L. S. Morgan, Chief, Mine Drainage Sec., 413 First National Bank Bldg., Greensburg, Pa.

June 4-6—Tuscaloosa, Ala. (*Univ. of Alabama*)
ALABAMA WATER & SEWAGE ASSN., Secy., E. J. Finnell, Jr., University of Alabama, University, Ala.

June 8-9—Ann Arbor, Mich. (*Univ. of Michigan*)
INDUSTRIAL WATER CONSERVATION COURSE, School of Public Health.

June 11—York, Maine
MAINE WATER UTILITIES ASSN., Secy., G. F. Laurin, 89 Western Ave., Augusta, Maine

June 14-17—Honey Harbour, Ont. (*Delawana Inn*)
6TH INDUSTRIAL WASTE CONF., Secy., D. S. Caverly, Ontario Water Resources Comm., East Block Parliament Bldg., Toronto, Can.

June 15-19—New York, N. Y. (*Manhattan College*)
FOURTH COURSE ON BIO-OXIDATION OF ORGANIC WASTES THEORY AND DESIGN, Prof. W. Wesley Eckenfelder, Civ. Engrg. Dept., Manhattan College, New York 71, N. Y.

June 17-19—Cincinnati, Ohio (*Netherland Hilton Hotel*)
OHIO SEWAGE & INDUSTRIAL WASTES TREATMENT CONF., Secy., Cleamon E. Lay, Ohio Dept. of Health, 101 North High St., Columbus 15, Ohio

June 17-19—Cedar Rapids, Iowa (*Roosevelt Hotel*)
IOWA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., L. F. Skorczeski, 207 South 15th Ave., Marshalltown, Iowa.

June 18—Wentworth, N. H.
NEW ENGLAND WATER WORKS ASSN., Secy., Joseph C. Knox, 73 Tremont St., Boston, Mass.

June 24-26—Minneapolis, Minn. (*Pick Nicollet Hotel*)
CENTRAL STATES SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Scott A. Linsley, P. O. Box 3598, Child Rd., St. Paul Minn.

July 12-17—San Francisco, Calif., (*Civic Auditorium*)
A.W.W.A. CONVENTION, Secy., Harry E. Jordan, A.W.W.A., 2 Park Ave., New York 16, N. Y.

July 12-17—San Francisco, Calif., (*Civic Auditorium*)
CALIFORNIA SECTION, A.W.W.A., In Conjunction with National Convention, Secy., Roy E. Dodson, Jr., San Diego Water Dept., Balboa Park, San Diego 1, Calif.

July 22-25—Berkeley, Calif. (*Univ. of Calif.*)
FIRST INTERNATIONAL CONF. ON WASTE DISPOSAL IN MARINE ENVIRONMENT, Prof. Erman A. Pearson, San. Engr., Research Laboratory, Univ. of Calif., Berkeley 4, Calif.

Aug. 12-14—University Park, Pa. (*Pa. State University*)
PENNSYLVANIA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., J. R. Harvey, 996 S. Main Street, Meadville, Pa.

Aug. 13—Vinal Haven, Maine
MAINE WATER UTILITIES ASSN., Secy., G. F. Laurin, 89 Western Ave., Augusta, Maine

Sept. 2-4—Huron, So. Dak. (*Marvin-Hughitt Hotel*)
SOUTH DAKOTA WATER & SEWAGE WORKS CONF., Secy., Don C. Kalda, Pierre, So. Dak.

Sept. 7-9—Jackson, Wyoming (*Jackson Lodge*)
ROCKY MOUNTAIN SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Verne E. Plath, P. O. Box 149, Englewood, Colo.

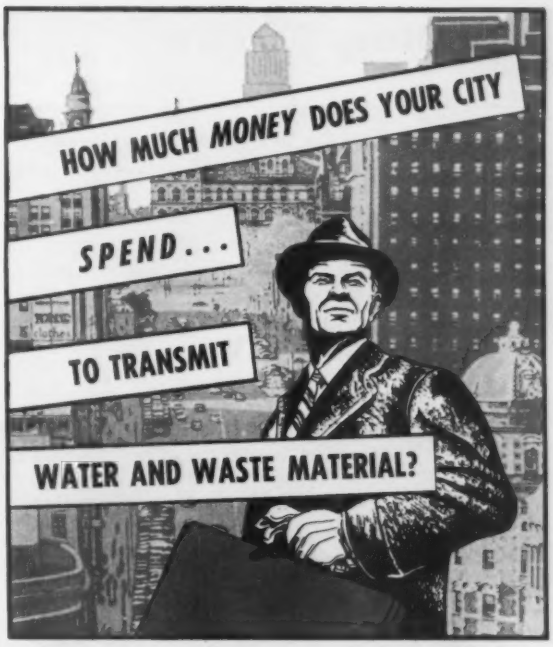
Sept. 9-11—Milwaukee, Wis. (*Hotel Schroeder*)
WISCONSIN SECTION, A.W.W.A., Secy., Harry Breimeister, City Engrs. Office, City Hall, Milwaukee 2, Wis.

Sept. 9-11—Altanta, Ga. (*Ga. Inst. of Tech.*)
GEORGIA WATER & SEWAGE ASSN., Secy., A. T. Storey, 1210 Hemphill Ave., N. W., Atlanta, Ga.

Sept. 13-18—Atlantic City, N. J.
136TH NATIONAL MEETING AMERICAN CHEMICAL SOCIETY, Secy., H. B. Gustafson, P. O. Box 5033, Tucson, Ariz.

Sept. 14-16—Lexington, Ky. (*Lafayette Hotel*)
KENTUCKY-TENNESSEE SECTION, A.W.W.A., Secy., J. Wiley Finney, Jr., Howard K. Bell, Cons. Engrs., 553 South Limestone St., Lexington, Ky.
(Jointly With)
KENTUCKY-TENNESSEE INDUSTRIAL WASTES & SEWAGE WORKS ASSN., Secy., S. Leary Jones, Cordell Hull Bldg., Nashville, Tenn.

Sept. 16-18—Upper Saranac Lake, N. Y. (*Sarnac Inn*)
NEW YORK SECTION, A.W.W.A., Secy., Kimball Blanchard, 19 W. 50th Street, New York 20, N. Y.



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SWP-24

Equipment News

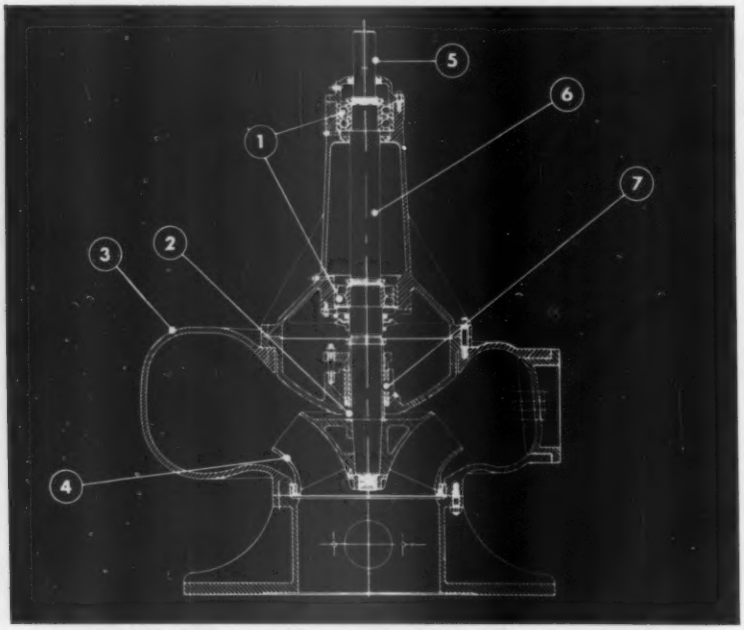
CONTINUED FROM PAGE 27A

20 Year Guarantee For Plastic Pipe

516

The Orangeburg Manufacturing Co., Orangeburg, N. Y., has announced the issuance of a 20 year bond guaranteeing the performance of its Orangeburg SP Plastic Pipe in cold water service lines. The Bond, backed by a national surety company, guarantees to the extent of the bond that any repairs or replacements due to failure of the pipe will be made at the expense of Orangeburg.

The company stipulates that the installer of Orangeburg SP Plastic Pipe comply with only a few simple installation instructions. Within 30 days after completing installation, the installer applies to Orangeburg for a a Bond covering the installation. After noting that all basic instructions have been followed, Orangeburg issues the 20 year Guaranty Bond to the owner.



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Hot Lead Jointing of Plastic And Cast Iron Sewer Pipe

517

Carlon Products Corp., Aurora, Ohio, has developed a new fitting which makes possible the joining of Carlon "D" plastic sewer and drain pipe with cast iron pipe by means of molten lead joints.

The new fitting is easily solvent welded to the plastic pipe. Normal procedure for making a hot lead joint is then followed to obtain a permanent connection with the cast iron. The metal pipe is inserted in the fitting, packed in with oakum and then wrapped with an asbestos rope. The asbestos is firmly clamped in place and the hot lead poured. Final tamping of the lead insures a tight seal.

Pump Operation Via Telephone Wires

518

Healy-Ruff Co., St. Paul, Minn., has announced that pump operation by remote control over telephone wires is now completely dependable with the RTM Roto-Trol.

Operating over one pair of telephone wires, the unit offers supervisory pump control at any distance experienced in a water system. New features include a powerful dual motor drive to operate the Healy-Ruff switching mechanism. Motor starters can be controlled direct from the heavy duty mercury switches. A multi-circuit pump controller, operating on the time impulse principle the RTM offers recording and indication when desired.

Precision Slurry Feeder

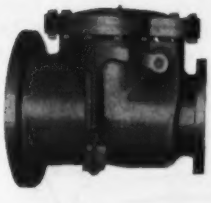
519

Precision Chemical Pump Corp., Waltham, Mass., has developed a line of slurry feeders designed specifically for diatomaceous earth slurries. Rugged, maintenance-free operation that multiplies filter run length by a factor of three to ten, and low initial

Continued on page 104A

CHECK VALVE SLAMMING

IS LIKE A SERIES OF BODY PUNCHES!



Little by little it "softens up" a pump discharge line for the final knock-out. Moderate slamming causes leakage, throws pipes out of line or causes other damage that may go undiscovered for years. Heavy slamming often causes serious damage and service interruption.

Why risk trouble and service loss? Ludlow and Rensselaer List 340 non-slamming check valves *are non-slamming under the most severe conditions,* thanks to adjustable spring tension. They are recommended as standard equipment wherever slamming is likely to occur.

WRITE TODAY for L&R Check Valves Catalog, showing 3" to 30" sizes, with or without lever arm and spring. All materials and workmanship exceed the A.W.W.A. requirements for gate valves and fire hydrants.

POSITIVE CONTROL OF AIR INLET OR DISCHARGE is afforded by Ludlow or Rensselaer air and vacuum and air release valves.

LUDLOW & RENSSELAER

VALVES AND HYDRANTS

THE LUDLOW VALVE MANUFACTURING CO., INC., TROY, N. Y. – SINCE 1861

Equipment News

CONTINUED FROM PAGE 102 A

cost are some of the features claimed by the company. In addition, the new feeders make it possible to combine all chemical feeding requirements, such as the addition of chlorine and sulfuric acid in one pump by the addition of independently controlled heads.

Designed for highly abrasive filter-aid and corrosive chemical slurries, the heavy-duty, positive displacement pumps incorporate an automatically controlled clear water flush system, integral with the pump. Pumping dependability over the full output range of 0-2.5 gph is assured. Output can be easily regulated while the pump is operating.

Another AERO-ACCELATOR® plant

The ideal sewage treatment plant for small communities, motels, industrial plants and institutions.

installed for Summit Park Sanitorium

The Summit Park Sanitorium at Pomona, New York, has installed another "AERO-ACCELATOR" activated sludge plant to handle its increased need for sewage treatment. The selection was based on five years performance of the first unit with consistently good treatment, and low operating and maintenance costs.

This type of plant will provide 90-95% B.O.D. and suspended solids removal. As a *plus* value, it will afford substantial savings in space and in the cost of installation because of its compact design.

"AERO-ACCELATOR" plants, described in Bulletin 6510, can be custom-designed for all municipal and industrial requirements regardless of capacity. It will pay you to investigate.

SEE YOUR CONSULTING ENGINEER if you are planning *any* installation. His services are essential for the design of the plant and selection of equipment that will best meet your requirements.

INFILCO Inc., General Offices • Tucson, Arizona
Field offices throughout the United States and in other countries

INFILCO

971

Submersible Pumps

520

Kenco Pump Div., American Crucible Products Co., Lorain, Ohio, has designed two new compact submersible pumps engineered for septic tank and sewage applications.

Featuring a non-clogging 2-vane impeller and special 1½ in .openings in the pump screen, these new pumps are ruggedly built with cast-bronze housing and powerful pumping capacity.

Each of these new pumps is lifetime lubricated, completely submersible, quiet and easy to install. The automatic models—119A and 130A—feature Kenco's built-in top-mounted control that has no floats to adjust, no rods to foul up or corrode. Pumping capacity of the Model 119 is 3300 gph at 10 ft. head, while the Model 130 will pump 5000 gph at 10 ft. head or 3300 gph at a 20 ft. head.

"WAIT till you see our new pipe handler from Alaska."

A sure sign of spring for 50 years...

IOWA *hydrant on the job—neat, attractive, efficient. Easily serviced by one man.*

IOWA *valves and hydrants ready for installation—a familiar scene in hundreds of communities.*

IOWA VALVES AND FIRE HYDRANTS • 1909-1959

• This spring—as every spring for the last 50 years—more and more IOWA valves and hydrants are being put in place to serve the needs of hundreds of growing communities.

This spring, more than ever, waterworks officials and engineers will specify IOWA. Experience of 50 years shows them that IOWA valves and hydrants are built to specifications PLUS—have that extra quality of materials, that extra precise fitting and assembly that makes for longest life and easiest maintenance.

That's why IOWA products are a good buy—this year and every year. And IOWA's high standing in the waterworks field, backed by ample resources, assures parts and replacements will always be available for economical future maintenance. This long-time future service is part of what you buy at IOWA. That's why IOWA is a good company to do business with...this year...or any year.

Let us send you details on Iowa's complete line of valves and hydrants

IOWA

VALVE COMPANY

A Subsidiary of James B. Clow & Sons, Inc.

Oskaloosa, Iowa

FOUR reasons why Ford covers offer greater protection and convenience for every meter box installation . . .

1-2-3-4

DOUBLE LID METER BOX COVERS

Designed to provide the utmost in frost protection for pit meters, the "Wabash Cover" has a total depth of 9½ inches. Its extra depth, sloping skirt and 4" dead-air space between inner lid and top lid minimize heat loss from the top of the meter setting.

These covers can be provided in "standard weight" for ordinary service, or "extra heavy," when the lid will be exposed to traffic.

SINGLE LID METER BOX COVERS

Designed for sidewalk or lawn installation, Ford "Type A" covers are made for 15", 18", 20" and 21" meter boxes. Lids are inset.

Lifter Worm lock used on these covers helps speed meter readings. Screw jack action plus automatic attachment of the key to the bolthead make lid removal a simple, clean task.

MONITOR COVER

Designed for use on large tile — where a large lid opening is desirable — "Monitor Covers" consist of 1) a flange casting to fit on the tile, 2) a ring centered in place on the flange by a circular bead, and 3) a top lid with Lifter Worm Lock.

These covers can be used for 1½" and 2" meters . . . or for two or more smaller meters. Lid size permits meter reader to enter setting if necessary.

HINGED LID

Designed for same installations as other single lid covers, "Type X cover" features hinge effect so lid can simply be leaned back instead of lifted off while meter is read.

Simple, ingenious lugs in the frame casting pivot the lid and support it. Thus, if desired, it can also be completely lifted off.

For more information, write . . .

FORD

FOR BETTER WATER SERVICES

THE FORD METER BOX COMPANY, INC. Wabash, Indiana

PAYNE DEAN VALVE OPERATOR

MAKES *EVERY VALVE POWER OPERATED*

PAYNE DEAN & CO. CLINTON, CONN.

News of Suppliers

Glover Heads Cochrane Industrial Waste Dept.

Cochrane Corporation, Philadelphia, Pa., has announced that George E. Glover has been named Manager of the Industrial Waste Department of the Company. He will be in charge of the Company's activities in industrial waste treatment and special ion exchange applications.

Mr. Glover is long experienced in the design, application and operation of industrial waste water treatment equipment including that of metal working solutions. He is also an author on this subject and a member of the Committee of the American Water Works Association for Underground Disposal of Wastes.

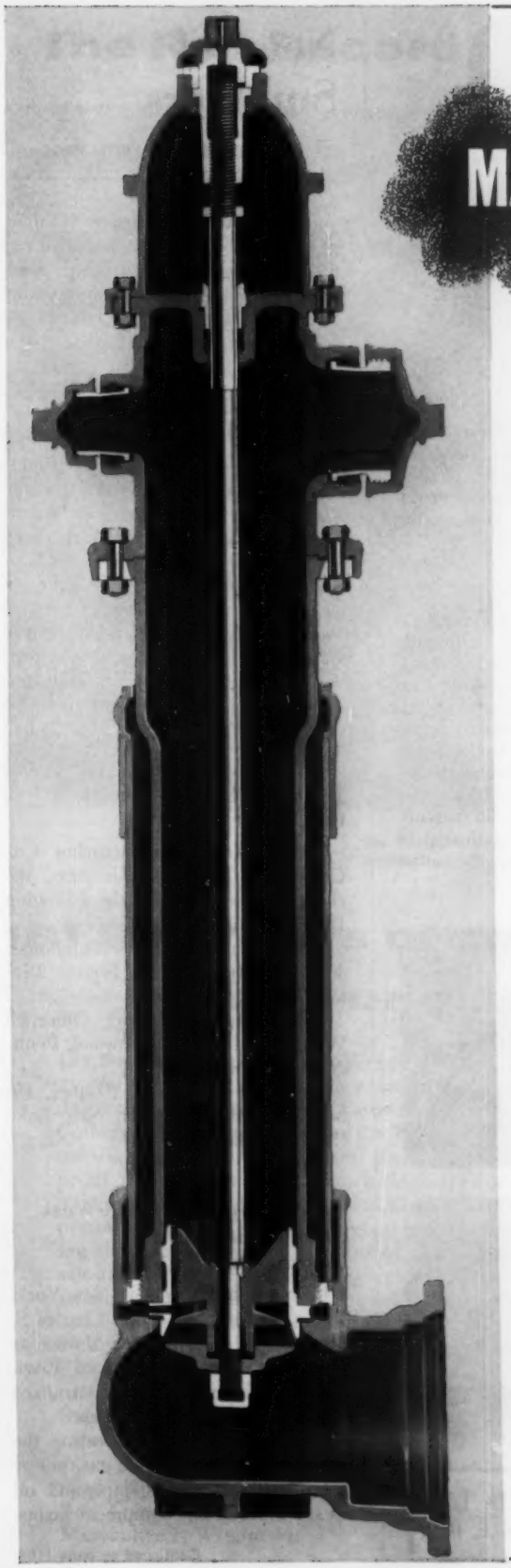
Chicago Pump Broadens Licensing of CRP System

Chicago Pump Company, Chicago, Ill., has announced the broadening of licensing under its patents, of the use of the CRP Accelerated Sludge Digestion System, through the specification of consulting engineers with gas recirculation equipment supplied by approved and experienced manufacturers.

The CRP Accelerated Sludge Digestion System, under United States Patent numbers 2,777,815 and 2,786,025 incorporates gas recirculation in digestion tanks for high-rate digestion and is currently in operation or being installed in 43 installations. Eight of the plants are operating with digestion volume equivalent from ⅓ to ⅕ past low-rate practice, or at approximately 2.3 cubic feet per capita.

The gas recirculation apparatus utilized in conjunction with CRP Accelerated Sludge Digestion System is simple in design and operation and is easily installed in new or existing tanks. The equipment is designed to maintain the primary digester in a homogeneous condition to assure proper conditions for sludge digestion

Continued on page 108A



MATHEWS HYDRANTS

THE MATHEWS MODERNIZED HYDRANT SUPPLIES THE 4 FUNDAMENTAL REQUIREMENTS FOR EFFECTIVE COMMUNITY PROTECTION

and many other quality features, too

- Replaceable barrel for maximum efficiency—quickly replaced in case of accident without excavating
- Head revolves 360°; simply loosen bolts and rotate
- Stuffing box plate cast integrally with nozzle section—eliminates extra part and provides positive, leakproof construction
- Operating thread, protected by stuffing box plate, operates free of rust, sediment and ice

Also . . . Nozzle sections supplied with hose or pumper outlets as specified • Operating thread cannot be bent • Compression-type main valve prevents broken Mathews from leaking • Nozzle level can be raised or lowered without excavating • Bell, mechanical-joint, or flange-type pipe connections • Conventional or "O" ring packings

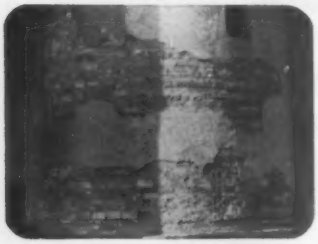
Made by

R. D. WOOD COMPANY

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

THORITE and **THOROSEAL** repaired these silos and made them waterproof!



CAUSE

The freeze-thaw cycle caused extreme damage to the masonry of these silos. Heavy cement surfacing deteriorated, exposing brick and mortar, vulnerable to water.

CORRECTION

All loose and scaling concrete was thoroughly removed by wirebrush, hammer, chisel or sandblasting. Reinforcing mesh was then locked to the exposed brick, over which THORITE, a twenty-minute set patching compound, was troweled, bringing the surface level with surrounding concrete. Immediately after, the THORITE patch and all silo masonry surface was sealed with brush coat of THOROSEAL to protect the entire structure.

Opposite photo shows huge crevices caused from deterioration and would ordinarily require forming into which concrete would be poured. THORITE eliminated this costly procedure. THORITE does not slump and can be formed by trowel to any contour of surrounding surfaces, as shown in these opposite pictures.

ALL ABOUT THE THORO SYSTEM

Write for our NEW 20 page brochure!

Standard Dry Wall Products Inc.

NEW EAGLE, PA. CENTERVILLE, IND.

News of Suppliers

CONTINUED FROM PAGE 106A

and to eliminate transfer of undigested material to ultimate point of disposal. Scum and floating solids are non-existent under continuous operation of adequately engineered gas recirculation facilities.

Butler Sales Manager W-K-M Plug Valves

W-K-M, Division of ACF Industries, Inc., Houston, Texas, has announced the appointment of Robert D. Butler as Sales Manager, Plug Valves.

Mr. Butler has had five years of experience as a sales representative for the company in the southeastern United States. Last year he was promoted to Assistant to Sales Manager, Plug Valves. He will continue to be located in Houston.

Jeffrey Moves District Offices

The Jeffrey Manufacturing Co., Columbus, Ohio has announced the changes of address for the following District Offices:

Birmingham Office and Warehouse. 3012 Fourth Avenue, South, Birmingham 5, Alabama.

Philadelphia District Office, 7 Wynnewood Rr., Wynnewood, Pennsylvania; and

Salt Lake City District Office, 15-N West Temple Street, Salt Lake City 16, Utah.

Harris Appointed Mid-West Sales Manager For Hammarlund

Hammarlund Mfg. Co., New York, N. Y., has announced that Charles S. Harris, has assumed his duties as Mid-West Sales Manager of Engineered Products, featuring Centralized Operational Control Equipment.

Mr. Harris will be contacting the municipalities; the water, gas, power and telephone utilities, pipe and oil lines, and electronic equipment manu-

Continued on page 110A

The Rex Record at Racine, Wisconsin

Rex Primary Sludge Collectors at the Racine, Wis., sewage disposal plant. Rex Equipment at this plant includes longitudinal and cross collectors... grit collectors and washers... bar screens and triturators.

181,800 hours of continuous operation... with original equipment

181,800 hours of continuous operation... almost *21* years of service 365 days a year, 24 hours a day... that's the record Rex Conveyor Sludge Collectors have established at the Racine, Wisconsin, sewage treatment plant. Here's definite proof of the design and manufacturing superiority of Rex Equipment. Rex Z-Metal Chains, Temperim sprockets, case-hardened centralized wearing shoes, accurately made redwood flights and self-aligning underwater bearings, plus balanced strength, flexible design and the other Rex "extras," put extra life into Racine's Rex Conveyor Sludge Collectors... both longitudinal and cross collectors.

If you're interested in record service like Racine's why not investigate Rex Waste Treatment Equipment. In the broad Rex line, there's exactly the right choice for you... from screening to clarification. For all the facts, write CHAIN Belt Company, 4610 West Greenfield Avenue, Milwaukee 1, Wisconsin.

Thomas T. Hay, superintendent of Racine Sewage Treatment Plant since 1941. His careful operation and maintenance practices have been a major factor in this record performance. Consulting Engineers: Alvord, Burdick & Howson, Chicago, Illinois.

REX®

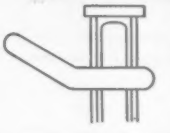
CHAIN BELT COMPANY

Cleveland "J" digs 20'/m through scored pavement

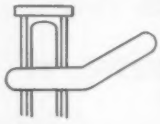
This Cleveland J-20, digging for 4 and 6-inch pipe on a Colorado utilities job, averaged 20 feet per minute as it cut through scored pavement and 8 inches of frost. Note the clean neat cut through paving and frost. Contractor's report indicates he was particularly pleased with the J-20's easy maneuverability as well as its high production on this job. *All* operations of the J-20 are controlled at the operator's seat.

V Conveyor
...permits faster, higher spoil discharge, higher heaped loads without clogging.

Hydraulic Conveyor Shift
...permits digging past poles, trees, etc., without interrupting other operations.

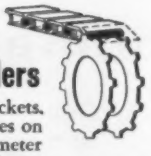


Independent Hydraulic Drive
...controls conveyor speeds and direction of discharge.



Hydraulic Crumbing Shoe
...optional, extra... pivots upward... allows setting wheel to required depth at walks, drives, underground obstructions.

World's Finest Trencher Crawlers
...double flanged sprockets, wheels, rollers...drives on each end of 1½" diameter hardened pins...eliminates plugging...sealed ball and roller bearings...1,000-hour lubrication...a tremendously long-lived, easy-rolling track.



Get Bulletin L-104 on Cleveland "J" trenchers from your local distributor ...or write:

The CLEVELAND TRENCHER Co.

20100 ST. CLAIR AVE. • CLEVELAND 17, OHIO

Good Everywhere

News of Suppliers

CONTINUED FROM PAGE 108A

facturers in a wide area of the mid-west.

Before joining Hammarlund, Mr. Harris was employed as Vice President and General Manager of Canaday Sound Co., Inc., in New York, engaged in the promotion of industrial sound equipment. Prior to this, he was a Vice President and principal stockholder of Centralized Audio Corporation of Newark, N. J., in which he still retains an interest and is a principal stockholder.

The new Hammarlund sales office for the mid-west will be located at 1509 North Ridge Avenue, Arlington Heights, Illinois, Tel. Clearbrook 9-4288.

King Appointed V.P. Sales McWane C.I. Pipe

McWane Cast Iron Pipe Co., Birmingham, Ala., has announced the appointment of T. L. Johnson as Vice President, Sales.

For the past 25 years, Mr. Johnson has been Sales Manager, Pacific States Cast Iron Pipe Co., Provo, Utah, which is an affiliate of McWane Cast Iron.

Mr. Johnson is well known in the cast iron pipe industry. He and Mrs. Johnson will make their home in Birmingham.

Mr. Johnson succeeds W. P. Cox "Pete" who is retiring after 37 years as head of the sales department.

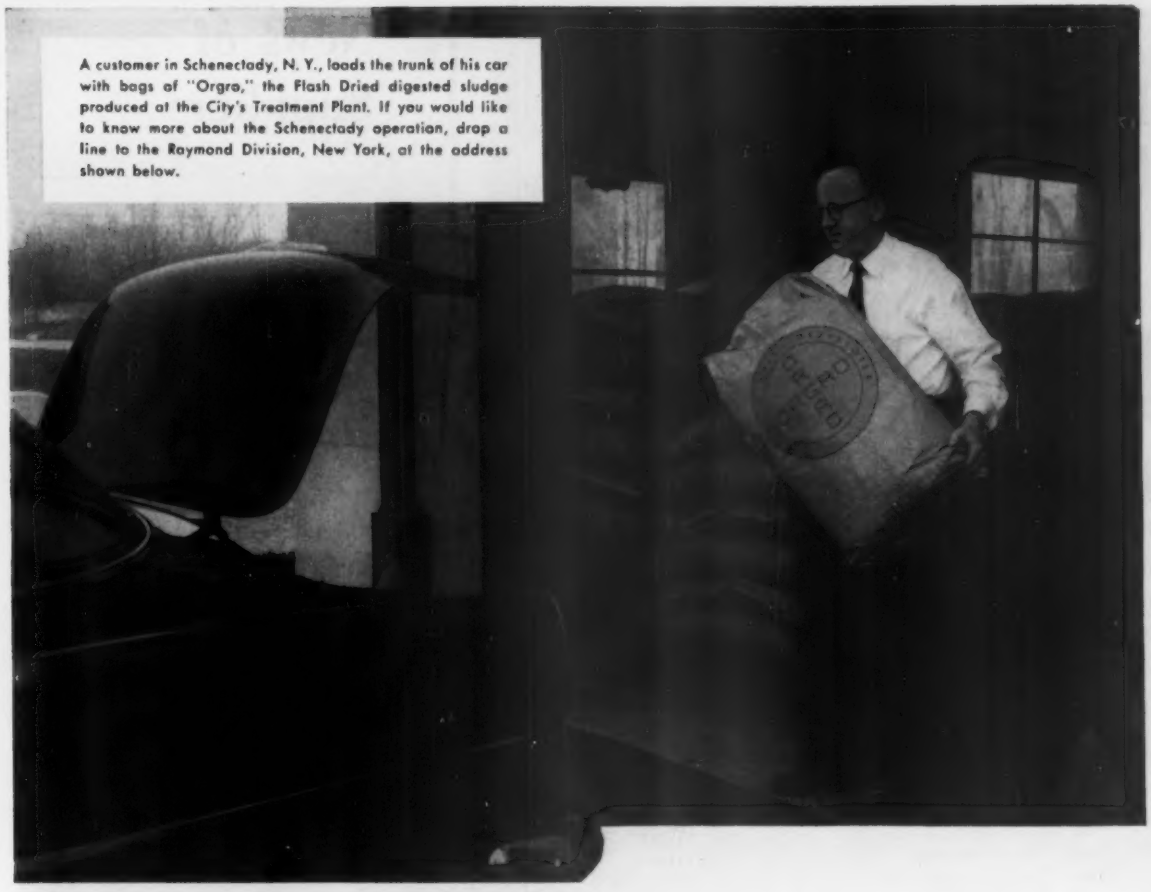
Sales Changes at Pacific States

The Pacific States Cast Iron Pipe Company of Provo., has announced a series of major advancements in its sales department.

Mr. T. L. Johnson was promoted to the position of vice president-sales of McWane Cast Iron Pipe Co., Birmingham, Ala. He replaces W. P. Cox who retired.

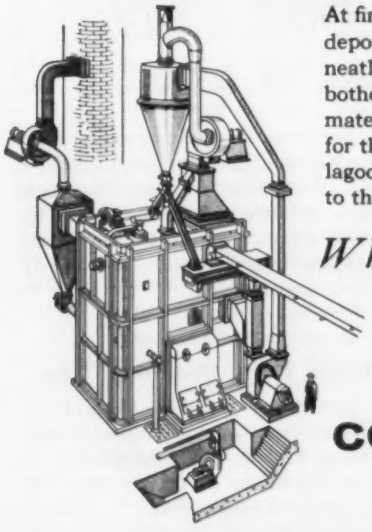
Mr. Johnson, for many years sales manager of Pscipco, has been succeeded by L. Glade Anderson who

Continued on page 112A



A customer in Schenectady, N. Y., loads the trunk of his car with bags of "Orgro," the Flash Dried digested sludge produced at the City's Treatment Plant. If you would like to know more about the Schenectady operation, drop a line to the Raymond Division, New York, at the address shown below.

Can you think of a better way to dispose of sewage sludge?



At first glance, the trunk of a car may seem to be a peculiar place to deposit sewage sludge. But when the sludge is dry, sterile and neatly packaged, it can be a marketable commodity rather than a bothersome waste. When uncontaminated with noxious industrial materials, it is an excellent soil conditioner. Its sale produces revenue for the treatment plant, eliminates the nuisances of drying beds, lagoons and ash disposal and, at the same time, renders a service to the people of the community.

What's the best method of drying sludge?

It's the C-E Raymond Flash Drying System, a system used by communities large and small across the nation, a system proved in service and one which dries more filter cake than all other systems combined.

COMBUSTION ENGINEERING

C-159

RAYMOND DIVISION, 1315 North Branch Street, Chicago 22, Illinois
Eastern Office: 200 Madison Avenue, New York 16, N. Y.
Western Office: 510 West Sixth Street, Los Angeles 14, Cal.
Canada: Combustion Engineering-Superheater Ltd.

ALSO FLASH DRYING AND INCINERATION SYSTEMS FOR INDUSTRIAL WASTE DISPOSAL

THE V·NOTCH MEETS FUTURE DEMANDS, TOO

They tell us it's a growing America.

It is.

You know already you'll need to expand to keep pace with demand.

That's why the V-notch Chlorinator has such tremendous range. The precision shaped groove in a V-notch plug is made to control chlorine completely to one eight-hundredth of the maximum capacity of your machine. In fact, this is standard in some of the V-notch chlorinators.

Your W&T representative will help you size your V-notch chlorinator so that when your treatment needs step up—you simply snap in the next size rotameter.

Without buying a new machine, you get the same quick, accurate control in a new working feed range.

And, of course, the right plastics make the whole chlorinator chlorine-proof.

A booklet, "The V-notch Story" will tell you about all the W&T V-notch Chlorinator features. For your copy write Dept. S-133.94

WALLACE & TIERNAN INCORPORATED
25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

is your feeding problem peculiar to your operation?

Wallace and Tiernan's volumetric feeders are so flexible that each job is practically custom built. W&T's experience is broad enough to meet any challenge.

Try us-for information write Dept. MV-1.94

WALLACE & TIERNAN INCORPORATED
25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

News of Suppliers

CONTINUED FROM PAGE 110A

leaves the district sales manager position at Los Angeles and becomes assistant sales manager at Provo.

Mr. P. Ned Pope, takes over Mr. Anderson's assignment at Los Angeles.

J. Don Broadhead has been assigned to the Seattle office. He formerly was employed in the general office at Provo.

Badger Promotes Burns and Floyd

Badger Meter Mfg. Co., Milwaukee, Wis., has announced the appointment of Ross J. Burns as general sales manager of the firm's municipal and industrial divisions.

Succeeding Burns as national water meter sales manager is Charles Floyd, Jr., who will headquarter in Milwaukee. Floyd previously was Badger's Southeastern district manager at Greenville, S. C.

Johnston also announced that Charles E. Kohl would continue to serve as national industrial meter sales manager with headquarters in Milwaukee.

Dyas Joins Hersey

The Hersey Manufacturing Company, Dedham, Mass., has announced that Charles R. Dyas of Cleveland Heights, Ohio has joined the company as a sales engineer.

Formerly a sales representative for the Cajon Machine Co., Cleveland, Mr. Dyas will represent Hersey in parts of Ohio, Indiana and Kentucky. He has been assigned to the Hersey Chicago branch under Michael H. Foley, manager.

Henry Pratt Promotes Two

The Henry Pratt Co., Oak Park, Illinois, has announced the promotion of F. J. Voss to the position of Vice President in Charge of Construction, succeeding W. T. Herren, who has retired. Formerly Superin-

Continued on page 114A

Newport News rack rakes . . . minimum-manpower way to keep water intakes free of debris

Newport News mechanical rack rakes are power-operated rakes for cleaning trash racks at water intakes, including those at hydro-electric plants, steam plants, pumping stations, and similar installations throughout this country and abroad. Under ordinary conditions, one man per shift keeps racks clean for a dozen bays.

Operate in channel guides for maximum cleaning action

A Newport News rake *won't ride over trash* nor will its teeth drop the debris, because the rake operates in channel guides for positive action. Special teeth are available for cleaning racks of filamentous algae, seaweed, etc.

The Newport News mechanical rack rake has been built to operate in bays from 5 feet 6 inches wide to 28 feet 6 inches in width. Forebay design determines the maximum width for a single rake. In the case of a very wide bay, intermediate guides are sometimes used to reduce the length of the rake. There are many typical installation arrangements to fit your needs. Newport News engineers are prepared to individualize these designs for you.

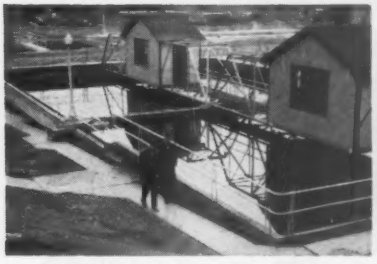
If you have a debris problem, write for a copy of THE NEWPORT NEWS MECHANICAL RACK RAKE, an illustrated booklet describing the installation, operation, and advantages of a Newport News rake.

Engineers . . . Desirable positions available at Newport News for Designers and Engineers in many categories. Address inquiries to Employment Manager.

Newport News
Shipbuilding and Dry Dock Company
Newport News, Virginia

Hardinge Center-Column Clarifier recently installed at the Hagerstown Sewage Plant

another HARDINGE Clarifier for HAGERSTOWN



Original installation: Two Hardinge Rotary Clarifier Mechanisms in rectangular tanks.

Second installation: A Hardinge Primary Clarifier doing heavy duty.

- *1932*—The City of Hagerstown, Maryland, installed its first Hardinge equipment in their sewage treatment plant—two 50' x 12' rotary mechanisms for final clarification.
- *1949*—The City of Hagerstown, installed a 55' diameter Hardinge circular beam-type primary clarifier for raw screened sewage in their disposal plant—H. E. Rhodes, Superintendent.
- *1958*—The City of Hagerstown installed the 60' diameter Hardinge center-column circular clarifier pictured above, for additional final clarification in their activated sludge plant—J. L. Eyerly, Superintendent.
- *Today*—The Hagerstown Sewage Plant is now processing an average of six million gallons of sewage daily with Hardinge units, old and new alike, in full operation.

HARDINGE
COMPANY, INCORPORATED

YORK, PENNSYLVANIA • 240 ARCH ST. • Main Office and Works
New York • Toronto • Chicago • Hibbing • Houston • Salt Lake City • San Francisco • Birmingham • Jacksonville Beach

News of Suppliers

CONTINUED FROM PAGE 112A

tendent of Construction for the company, Mr. Voss heads a division that specializes in the installation of power plant mechanical equipment.

Mr. H. C. Schwenk, formerly Valve Sales Manager, has been promoted to the newly created post of Sales Manager of Manufactured Equipment.

Fisher Completes Building Program

Fisher Research Laboratory, Inc., Palo Alto, Calif., has just completed an extensive program of new construction and modernization at their existing plant location. Newly con-

structed are 4,000 square feet providing for increased laboratory, administrative, and shipping requirements. Research and Development facilities have been doubled in space and completely modernized to keep pace with an expanded engineering program. The company has been manufacturing at the same site on University Avenue in Palo Alto since 1939.

F & P Names Dismukes Water & Waste Manager

Fischer & Porter Co., Hatboro, Pa., has announced the appointment of Doug Dismukes to the newly created position of Water & Waste Industry Manager.

Mr. Dismukes, formerly a field engineer in the F&P Philadelphia office, has been with F&P for 15 years. He is a graduate of Princeton 1930 and is a member of the ASME and ISA.

Inset photo shows the Christy contour gasket applied around an ALOXITE porous plate. Effective sealing is demonstrated in the installation photo that is shown above.

New contour gasket forms positive seal between ALOXITE® plates—simplifies installation

A new "plus" is now added to the advantages of ALOXITE aluminum oxide porous-plate underdrains . . . a faster, greatly simplified and thoroughly positive method of sealing between plates, entirely without joint cement!

The new method involves use of a synthetic contour gasket that fits around each plate. When the plates are laid as shown above, the gaskets form a tight, continuous joint. A bead molded around the gasket insures close contact.

Since jointing with cement or asphaltic compounds is eliminated, effective sealing no longer depends on care in applying cement or attention to temperature and consistency. Pores cannot be clogged, as sometimes happens, by cement slopping over onto the plates. Installation time is reduced. If it ever becomes necessary, individual plates can be readily removed or replaced at any time without breakage or damage to the rest of the bottom.

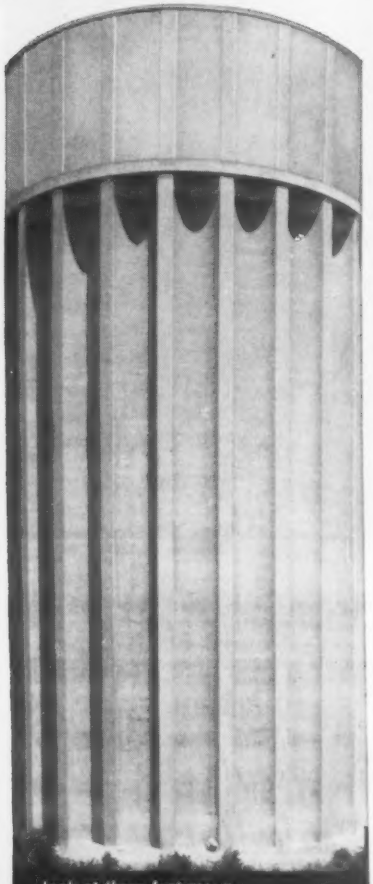
The new gaskets are sold for about 50¢ each by the Christy Firebrick Company, 506 Olive Street, St. Louis 1, Missouri. They are available from stock.

For further information on ALOXITE porous underdrains write Dept. X-59, Refractories Division, The Carborundum Company, Perth Amboy, N. J.

CARBORUNDUM

Registered Trade Mark

MORE THAN 2000 PRESTRESSED CONCRETE TANKS IN SERVICE



Look at these features:

- No maintenance required
- 75% construction cost spent locally
- Lowest overall cost to community
- Owners never return to other types
- Longest service life of any tank

Send for Bulletin T-22

PRELOAD

THE PRELOAD COMPANY, INC.
211 East 37th St., New York 16, N. Y.
351 Jefferson, Dallas, Texas
711 Perimeter Road, Kansas City, Mo.

PRELOAD CONCRETE STRUCTURES INC.
837 Old Country Road
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HERRICK IRON WORKS
28400 Clawiter Road
Hayward, California

THE CANADA GUNITE COMPANY, LTD.
7325 Decarie Blvd.
Montreal 16, Canada

New Bulletins

AVAILABLE FREE

Plating Waste Treatment

521

Graver Water Conditioning Co., New York, N. Y., has available a paper on Variations in the Design of Plating Waste Treat Systems.

This article, discusses the various systems and methods, both batch and continuous, which may be used in the treatment of hexavalent chromium, cyanides, acids and alkalis.

The paper points out that while the chemical treatment of these wastes is essentially the same, treatment equipment and plant design can vary considerably depending upon a variety of fatcors. These factors are discussed and case studies are cited to show how they are involved in practical waste treatment plant design.

Illustrated with appropriate flow diagrams and cutaways of treatment units, the paper is available from Graver without obligation.

Spectrophotometer

522

Beckman/Scientific and Process Instruments Div., Fullerton, Calif., has available a new six page brochure, Accessories for the Beckman Model B Spectrophotometer.

The bulletin describes accessories for flame photometry, diffuse reflectance, paper strip chromatography, and test tube analyses, and gives applications information for each Model B-accessory combination.

Butterfly Valves For Altitude Tank Control

523

B-I-F Industries, Inc., Providence, R. I., has published a new bulletin describing the use of a Builders-Providence Butterfly Valve with a B-I-F Altitude Valve Controller for making an efficient, low cost altitude valve.

According to the bulletin the new system for altitude tank control consists of a Builders-Providence Model BV tight closing, rubber seated but-

Continued on page 118A

LIFT MORE SEWAGE FOR LESS MONEY

Compact ejector system, motor compressor assembly and all controls in one "packaged" unit. Also made in twin units.

60 YEARS OF EXPERT KNOW-HOW

CALL ON
BLACKBURN-SMITH

Hundreds of pump and lift stations giving uninterrupted service with "B-S" Pneumatic Sewage Ejectors, single or twin units. Capacity 30 to 500 g.p.m. Heads up to 150 ft. No complex piping, screens, impellers, shredders, etc. Lowest installations operating, maintenance costs.

WRITE FOR CATALOG S-55

Shows application, advantages, dimensions and layouts of B-S Pneumatic Sewage Ejectors, single and duplex units. Describes exclusive features of float, electric and pneumatic controls. Tells how to select proper size ejector.

BLACKBURN-SMITH MFG. CO., INC.
51 GARDEN ST. HOBOKEN, N. J.
Oldfield 9-4425
N. Y. Tel. BArclay 7-0600

THE U. S. TREASURY SALUTES THE AUTO INDUSTRY

—and its thousands of employees who help strengthen America's Peace Power by buying U.S. Savings Bonds

The huge team that plans, builds and markets the cars America drives is making another great contribution to our national security. Thousands upon thousands of auto industry employees are buying U. S. Savings Bonds, regularly, through the Payroll Savings Plan.

Regular purchase of Shares in America helps these forward-looking people set up their own reserves for home building, for education and for greater security after retirement. The Payroll Savings Plan provides a sound, automatic way to practice thrift.

If your company has not yet put in a Payroll Savings Plan, start now. It's easy! Just telephone your State Savings Bond Director for the help he is eager to give you. Or write to Savings Bond Division, U. S. Treasury Department, Washington, D. C.

Henry V. Pogorzelski, pictured at work in one of America's great automobile plants, is typical of the thousands of skilled employees in this field who are buying U.S. Savings Bonds regularly. Mr. Pogorzelski uses his company Payroll Savings Plan to make his contribution to the Peace Power of his country.

WATER & SEWAGE WORKS

THE U. S. GOVERNMENT DOES NOT PAY FOR THIS ADVERTISEMENT. THE TREASURY DEPARTMENT THANKS, FOR THEIR PATRIOTISM, THE ADVERTISING COUNCIL AND THE DONOR ABOVE.

Crispin

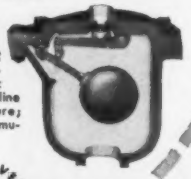
AIR VALVES

...keep pipelines open for safe, economical operation

Simplified construction, easy accessibility, maximum durability and efficient cost-saving operation are basic in every Crispin Air Valve.

Crispin UNIVERSAL AIR VALVES ... positive, full-time air control when line is filled, in operation or emptied.

Crispin AIR & VACUUM VALVES ... permit air to escape as line fills, allow air to enter as line empties.



Crispin PRESSURE AIR VALVES ... provide automatic air escape while line is under pressure; prevent air accumulation in line.

AIR CONTROL VALVES FOR OVER 45 YEARS

multiplex

MANUFACTURING COMPANY

BERWICK, PENNSYLVANIA

Dept. B

Write, wire or phone for complete information on dependable Crispin Air Valves that keep your pipelines open for safe, economical operation.

GUNITE does it 2 times as fast at 1/2 the cost

"Gunite" is the modern process (sand and cement applied pneumatically) for repairing, constructing, lining:

- Reservoirs
- Dams
- Filter Plants
- Sewage Disposal Plants
- Tanks
- Stadiums
- Bridges
- Sea Walls
- Swimming Pools, etc.

WRITE FOR MORE INFORMATION, INCLUDING 48 PAGE "GUNITE" BOOKLET.

PRESSURE Concrete Co.

FLORENCE, ALA. 1555 Helton Street

OTHER OFFICES IN

CHICAGO, ILL. 30 W. Washington Street

NEWARK 5, N. J. 193 Emmet Street

New Bulletins

CONTINUED FROM PAGE 116A

terfly valve, sizes 4" to 72" available, and a B-I-F altitude controller. The unit assures full stroke at time of tripping (no creeping) and adjustable speed of opening and closing, if required.

The new bulletin features explanatory text, several installation drawings for single and double acting altitude control, and a line drawing of the hydraulic latitude valve controller. Some of the many advantages of using butterfly valves on altitude tank control are: absence of springs, low head loss, no small lines or orifices to clog up, no line strainers required, wide band adjustment from ½ to 15 psi, easy to install and adjust, and repeatability of control point.

Submersible Pump Motor

524

General Electric Co., Schenectady, N. Y., has just released a bulletin on their new Submersible Motor. The six page bulletin describes design and performance features of this first oil-filled motor ever marketed as a complete unit for four-inch well applications. Illustrated publication contains motor ratings and dimension chart with cutaway view of the motor. All mounting dimensions conform to NEMA standards for submersible water-pump motors.

In-Line pH Control

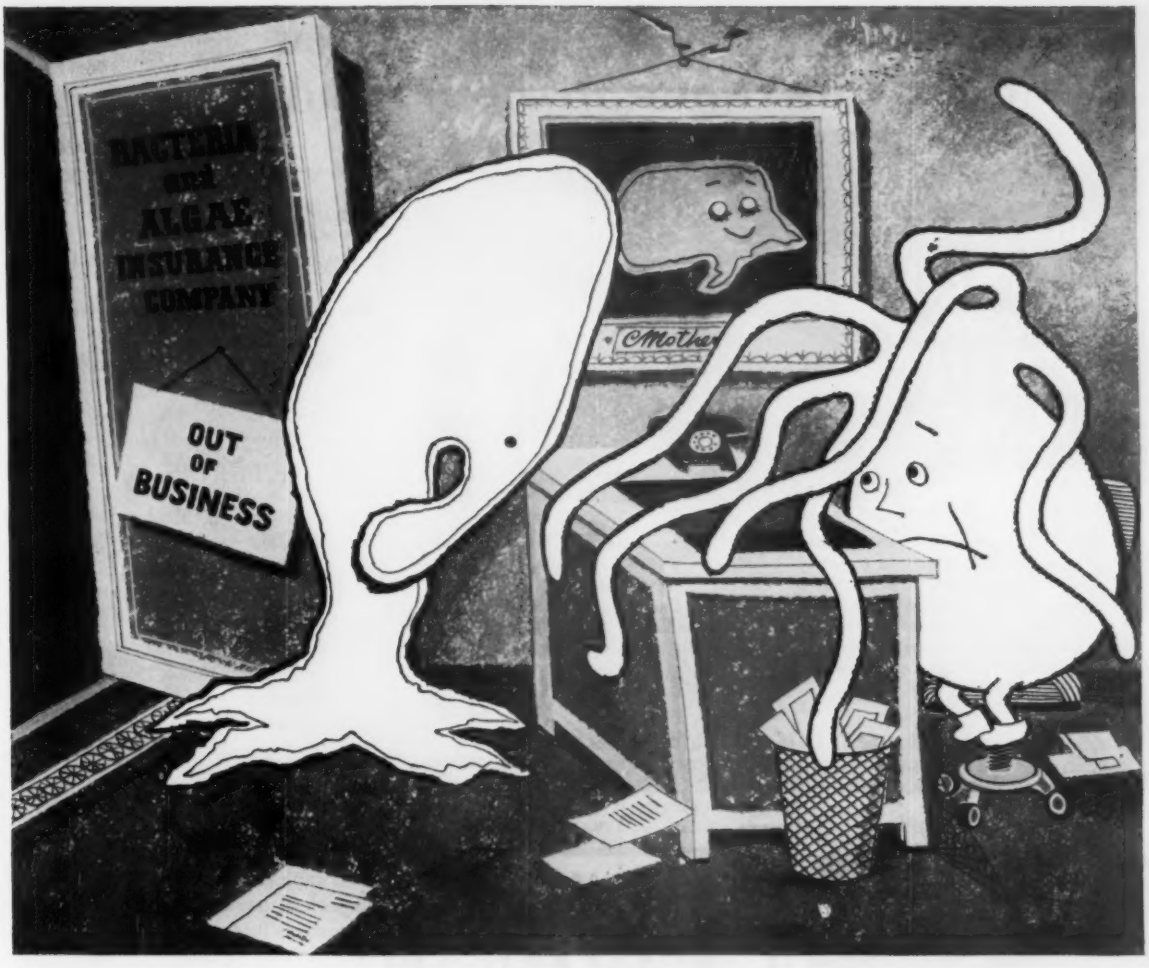
525

Beckman Scientific and Process Instruments Div., Fullerton, Calif., has released an Application Data Sheet on In Line pH Control for Continuously Pressurized Processes.

This data sheet describes the use of Beckman Stopcock Glands with a standard industrial pH meter and ruggedized electrodes, for high temperature—high pressure pH measurements of sludge at the sewage treatment plant of the East Bay Municipal Utility District, Oakland, California.

Illustrations show the high pressure installation in the sewage treatment plant, as well as the Stopcock Gland

Continued on page 120A



"Our business is busted, Orgie... we can't fight PITTCHLOR®!"

You're right, Algie. You haven't got a chance of holding onto customers because Pittchlor kills chlorine-susceptible bacteria and algae instantly. That's why it's such a big favorite of water works and sewage disposal plant operators.

Pittchlor kills such microorganisms on contact because it is a high-test calcium hypochlorite containing a minimum of 70% available chlorine. Its granular form provides quick chlorine release and permits easy application either manually or through mechanical feeders. In addition, you'll find it the perfect source for emergency and standby chlorination.

Dry, free-flowing Pittchlor provides economical chlorination of water supplies and sewage, helps in B.O.D. reduction, odor control, effluent disinfection, and is an aid to coagulation.

Pittchlor is highly stable and retains its chlorine strength when stored for reasonable periods.

Stock up on Pittchlor now. Just contact your nearest Columbia-Southern distributor today.

PITTCHLOR—Packaged in resealable cans, 5 lb. (9 per case) and 3¾ lb. (4 per carton). Also in 100 lb. drums.

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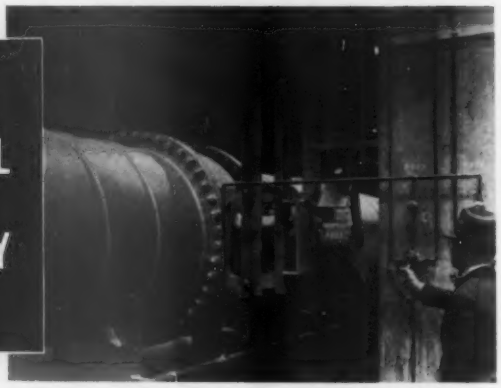
A Subsidiary of Pittsburgh Plate Glass Company · One Gateway Center, Pittsburgh 22, Pennsylvania

DISTRICT OFFICES: Cincinnati · Charlotte · Chicago · Cleveland · Boston · New York · St. Louis Minneapolis · New Orleans · Dallas · Houston · Pittsburgh · Philadelphia · San Francisco

IN CANADA: Standard Chemical Limited

at the Massena, N. Y., intake of the St. Lawrence Project

they've installed ROCKWELL AWWA BUTTERFLY VALVES



Yes, five 48" diameter Rockwell valves passing some 40 million gallons of water daily. Two of these valves at the canal intake are equipped with extended stems and worm gear handwheel units for remote control; the three valves in the power plant are equipped with hydraulic cylinders and 4-way control valves. All have Rockwell's exclusive Wedge-Lock rubber seat insert for drip-tight shutoff.

There are many such successful Rockwell valve installations for water applications. Bulletin 581 tells why.

ROCKWELL SINCE 1888 BUILT

W. S. ROCKWELL COMPANY

Valves—Butterfly · Slide · Diaphragm · Special

2829 ELIOT STREET • FAIRFIELD, CONN.

HEAVY-DUTY
ELLIS PIPE CUTTER
FOR CUTTING LARGE SIZE PIPE

Drop-Forged Frame and Links

Long-Lasting Cutter Wheels

Makes a Hit With Water Works Men

Cuts Pipe in or Out of Ditch

TWO SIZES
No. 01 for 4" to 8" Pipe
No. 1 for 4" to 12" Pipe

Write for Circular and Price List No. L41

ELLIS & FORD MFG. CO.
P. O. BOX 308
BIRMINGHAM, MICHIGAN

FISHER finds it faster!

All-new 1959 Transistorized

M-SCOPE PIPE FINDER

only *$189.50*

- Greatest depth penetration
- Greatest tracing distance
- Pinpoint accuracy
- One year between battery changes
- Built-in battery testers
- 90% less maintenance costs

New, Transistorized
LEAK DETECTOR

- Finds leaks faster, more accurately.
- Weighs 80% LESS than ordinary equipment.

only *$295.00*

SEND FOR FREE 1959 CATALOG

FISHER Research Lab., Inc.
Dept. WS-1, Palo Alto, Calif.

New Bulletins

CONTINUED FROM PAGE 118A

which allows removal of pH electrodes from a pressurized line without shutting down the flow of sludge.

Demineralization Handbook

526

Cochrane Corp., Philadelphia, Pa., offers a new, comprehensive forty-page book titled, "Handbook on Demineralizing." This handbook compares various methods of water treatment, as well as indicating the comparison between demineralizers and evaporators. It goes into the characteristics of the various types of available cation and anion exchange materials and offers data on operating costs of demineralizing.

It tells when to use two-bed, three-bed, four-bed, mixed or mono-bed Demineralizers. It also indicates when Decarbonators or Vacuum Deaerators are required. The bulletin is replete with typical flow diagrams, photos of installations and the chemical results obtained with demineralization. This Cochrane Handbook is a valuable and important handbook for engineers or executives interested in modern water conditioning systems.

Water Equivalents and Data Card

527

Industrial Chemicals, Inc., South Bend, Indiana, has available a wallet-size plastic card containing data including water equivalents and estimated water requirements for steam generation, refrigeration and cooling.

Plastic Waste Disposal Product

528

The Dow Chemical Co., Midland, Mich., has completed a 32 page bulletin about Dowpac, the company's new plastic packing material used in the biological oxidation of liquid wastes.

According to Dow, the bulletin is of interest to all persons concerned with waste disposal, both industrial and municipal.

The bulletin contains illustrated in-

Continued on page 122A

This prestressed concrete water tank was constructed in Kettering, Ohio, by Preload Concrete Structures, Inc., Westbury, L. I., N. Y. The Parlon-based finish, "Moisture and Chemical Resisting Enamel," is made by the Lowe Brothers Co., Dayton, Ohio.

200 GALLONS OF PARLON-BASED PAINT PROTECT THIS 3,000,000-GALLON TANK

There are many reasons for the ever-increasing preference of paints based on Hercules Parlon® chlorinated rubber. Wherever protective coatings must meet a challenge from the weather or the corrosive effects of chemicals, Parlon-based paints are providing longer service at lower long-term cost.

For this water tank in Kettering, Ohio, the coating selected had to meet two main tests—it had to be attractive and it had to require little maintenance. Parlon passed on both counts. Only 200 gallons in a single coat were needed to provide the tank with an attractive green coating. Fifteen months later the paint job retains its "just like new" look.

Perhaps the many unusual properties available in Parlon-based coatings can solve your own maintenance problems. Your local paint supplier can provide additional information, or write direct to Hercules.

Cellulose Products Department

HERCULES POWDER COMPANY

INCORPORATED

900 Market Street, Wilmington 99, Delaware

CR58-2

feco LIGHTNING
SURFACE WASH BAFFLES
for RAPID SAND FILTERS

• SAVE 50%
OF BACKWASH WATER
• PREVENT
SHORT CIRCUITING
• PROVIDE
EVEN DISTRIBUTION
• MAINTAIN
FILTER BALANCE
• GIVE LONGER
FILTER RUNS

PRODUCE A CLEAN FILTER BED
IN HALF THE BACKWASH TIME
WRITE FOR CATALOG No. 5-2

FILTRATION
EQUIPMENT CORP.
P. O. BOX 1331, ROCHESTER 3, N. Y.

New Item . . .
RTM ROTO-TROL

Multi-
Circuit
Pump
Controller

- Recording and Indication when Desired
- Suppressed Head Type
- Any Distance between Transmitter & Receiver

The RTM Roto-Trol operates on the time impulse principle. A tested and proved switching mechanism is operated by a powerful dual motor drive. The motor starters can be controlled direct from the heavy duty mercury switches.

Write for New Bulletin RTM

HEALY-RUFF Company
783 Hampden Ave., St. Paul 14, Minn.

New Bulletins

CONTINUED FROM PAGE 120A

formation on the product's physical properties, assembly instructions and operational characteristics.

Information also is given which explains the wide design latitude possible with Dowpac, and includes performance data gathered from a variety of pilot plant installations.

Hydrographic Data Book

529

Leupold & Stevens Instruments, Inc., Portland, Ore., has announced the sixth edition of their Hydrographic Data Book.

The handy 5½ x 8 in. handbook, of 124 pages, contains technical data on float operated water level recorders and numerous tables of hydraulic data.

Part I contains information on float wells and instrument shelters. Part II discusses error in float operated devices. Part III contains useful hydraulic tables and conversion charts.

The Data Book has been prepared and edited by J. C. Stevens, Dr. Eng., and is available direct from Leupold & Stevens Instruments Inc., for $1.00 per copy.

Organic Waste Digesters

530

Earp Laboratories, Inc., High Bridge, New Jersey, has just published a folder on the Bacti-Cycle Continuous-Flow Organic Waste Digesters.

The folder describes how the digester converts useless organic waste to valuable, salable humus within a period of 24 hours. According to the folder, this clean, fast, safe, economical method of treating organic wastes operates at 10, 25, and 50 tons per day rated capacity. It also ends the problems of dumps, land fill, and incinerators.

The folder includes a keyed cutaway drawing with explanatory text covering the cycles of operation. The balance of the folder presents questions most frequently asked about the process, and their answers.

Continued on page 124A

ENSLOW
STABILITY INDICATOR

For checking the equilibrium of a finished water, and supplying an index useful in controlling anti-corrosion treatment. Catalog No. 83-895

WRITE:
Phipps & Bird, Inc.
P. O. Box 2V Richmond 5, Va.

DOING ONE THING AND ONE THING WELL—

FOR OVER 60 YEARS!

ROBERTS FILTER
MANUFACTURING CO.
•
DEPENDABLE MODERN
WATER PURIFICATION EQUIPMENT
CALL OR WRITE

MECHANICAL EQUIPMENT BY
ROBERTS FILTER MFG. CO.
DARBY, PENNA.

Some of the 69 miles of 24- to 126-inch reinforced concrete pipe needed for the Pittsburgh sewer project

Pittsburgh chooses concrete pipe for sewer system designed to last 100 years!

The 70 communities of the Allegheny County Sanitary Authority have planned 100 years ahead for their new intercepting sewer system. This big project involves 69 miles of sewers—30 miles in tunnels and the rest open trench construction.

Needed strength, durability and watertightness are assured by concrete pipe. Extensive testing proved these qualities. Total infiltration into the first 31 miles completed was less than 3 gallons per minute. In many contract sections infiltration was found to be zero.

Other communities everywhere are also finding that concrete pipe can be designed precisely to solve their sewer problems. And concrete pipe are readily available. For the giant Pittsburgh project, special casting yards—including all test equipment—were set up at convenient close-in locations to speed up schedules, keep costs low.

For helpful information on modern concrete pipelines of all kinds, write for free literature. Distributed only in the United States and Canada.

For the Allegheny County Sanitary Authority: John F. Laboon, Executive Director and Chief Engineer; Lawrence M. Gentleman. Deputy Chief Engineer; Richard J. Dougherty, Construction Engineer.

PORTLAND CEMENT ASSOCIATION
Dept. A5-29, 33 West Grand Avenue, Chicago 10, Illinois
A national organization to improve and extend the uses of concrete

RARE OPPORTUNITY FOR BUSINESS AND PROFESSIONAL DEVELOPMENT
For Engineers With Experience and Capability

To Serve in Connection With Product Development and Sales Engineering Promotion and Guidance of a National Technical Sales Organization

These positions involve high-calibre product management and field promotional engineering work, as part of this Company's decentralization program and long-range plans for expansion in related equipment and process fields, inclusive of Industrial Wastes. All applications should contain full information on professional and business training and experience which would fit the applicant for a position of unusual challenge and promise. Also indicate range of initial compensation desired. Interviews will be arranged. All information will be held in strictest confidence. Address replies to:

MILTON SPIEGEL,
Vice Pres. & General Mgr.
Chicago Pump Company
622 Diversey Parkway
Chicago 14, Illinois

FOR SALE

500 G.P.M. 4"x4" American Well Centrifugal Service Pumps 1760 R.P.M.

Complete with 25 H.P. 3 phase 60 cycle 220/440 volt 1750 R.P.M. ball bearing motors mounted on frame; coupled; ready to operate; have been used and also overhauled.

Contact the Village of Oak Lawn Water Department, Charles Reich, Water & Sewer Supt., 5252 West James Street, Oak Lawn, Illinois, Telephone Garden 2-1313.

Superintendent—Water and Sewage Department—wanted, with minimum of 3 years administrative experience in operating water system and/or sewage disposal system. Engineering training desirable. New Sewage Treatment Plant nearing completion. Salary range $5,658.00 to $7,458.00. Send resume of experience and application to H. B. Vasey, City Manager, City Hall, Mankato, Minnesota.

Sales Representatives

Large and well established company is building an ultra modern cast iron pressure pipe foundry at Council Bluffs, Iowa scheduled to go into production March 1960. Will require salesmen for various offices to cover: Colorado, Dakotas, eastern Illinois, Iowa, Kansas, Minnesota, Missouri, Nebraska, Wisconsin. Applicants must be known in the Water Works Field. Previous sales experience desirable. Salary open and commensurate with experience, bonus plan and liberal fringe benefits.

Unusual opportunity to get in on the bottom floor of a new organization. All inquiries will be treated as confidential. Send resume to:

Mr. Frank Marold, Vice President-Sales
Griffin Pipe Division
445 North Sacramento Blvd.
Chicago 12, Illinois

Vacancy—Superintendent of Sewer Systems, salary $630-$725 per month, including liberal fringe benefits. Position heads the Division of Sewer Systems of Water and Sewer Department. The City operates one 30 MGD Activated Sludge Sewage Treatment plant and one 5 MGD Biofilter plant and maintains 600 miles of Sanitary Sewers. Applicants are required to have extensive experience in the operation and maintenance of Sewage Systems, including considerable supervisory experience; graduation from college or university with specialization in Sanitary, Civil or Mechanical Engineering. Informal application must be received within ten days from publication date. Leroy J. Brenneman, Personnel Director, City Hall, Phoenix, Arizona.

WANTED—Experienced and competent engineers for design or/and supervision of construction of water works, sewerage, water treatment and sewage treatment plants. Permanent position. State age, experience, education, salary required.

Box 6000—Water & Sewage Works
185 N. Wabash Ave.
Chicago 1, Illinois

WANTED

Sanitary Engineer to direct Division of Sanitation with generalized program in well established County Health Department. Population: 82,000. Liberal vacation, sick leave, retirement, longevity benefits. Cattaraugus County Health Department, 302 Laurens Street, Olean, New York. Salary: $6,564-$7,620.

Advertise in the 1959 WATER & SEWAGE WORKS Reference Number

New Bulletins

CONTINUED FROM PAGE 122A

Water, Sewage & Industrial Waste Treatment Equipment

531

The Jeffrey Manufacturing Company, Columbus, Ohio, has just released a catalog on Jeffrey Equipment for Water, Sewage and Industrial Waste Treatment.

Amply illustrated with drawings, charts and installations photographs, the catalog contains sections on: Water and bar screens; grinders; collectors; settling tanks; scum removers; Floctrols; feeders; conveyors; bucket elevators; chains and sprockets.

A detailed description on each piece of equipment is also included.

"The Mountain Boys"

532

United States Pipe and Foundry Co., Birmingham, Ala., has available an attractive 2-color booklet reprinting the series of "Mountain Boys" cartoons and captions, that have been used for illustrating the company's recent series of advertisements, emphasizing Tyton Joint Pipe.

Air-Stream Pollution Seminar Proceedings

533

American Cyanamid Co., New York, N. Y., has published the papers delivered at the air-stream pollution control seminar held in connection with the dedication last year of the company's $4,500,00 waste treatment facility at Bound Brook, N. J.

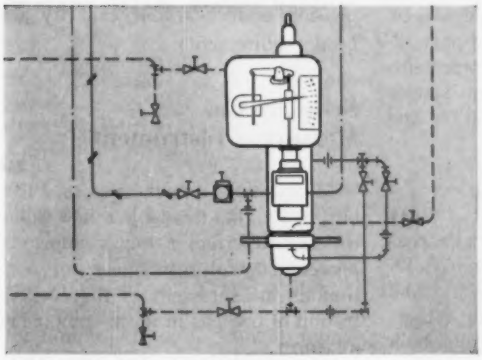
The seminar, jointly sponsored by the U. S. Public Health Service, New Jersey Department of Health, Rutgers University and Cyanamid, drew more than 250 pollution control specialists from industry, government and universities.

The booklet contains the following papers: National Air Pollution Control Program; State Air Pollution Control Program; Engineering Control of air Pollution Problems; National Stream Pollution Control Program; State Stream Pollution Con-

Continued on page 126A

FLUIDICS

is a Pfaudler Permutit program providing a modern, imaginative approach — plus the specialized materials and equipment — for handling and processing and controlling more profitably the liquids and gases which are the lifeblood of our manufacturing economy.



FLUIDICS AT WORK

New pneumatic transmission system more accurate, more dependable

The diagram shows a typical setup for the new Simplex system for transmitting rate of flow and loss of head to a receiver.

Rate of Flow

The new Type PN transmitter combines the exceptional accuracy and range of a differential converter operated by a mercury float with the traditional dependability of pneumatic transmission.

The transmitter consists of a differential converter which extracts the square root flow function from a primary and then positions a pneumatic motion transmitter. The transmitter produces a pneumatic 3 to 15 psig linear signal. A booster pitot diaphragm in the motion transmitter insures a low lag coefficient and fast transmission.

Besides getting a linear signal without using supplementary pneumatic relays, this new unit gives you point accuracy over wide ranges of flow with minimum differentials. The booster permits accurate transmission over long distances with minimum lag.

Loss of Head

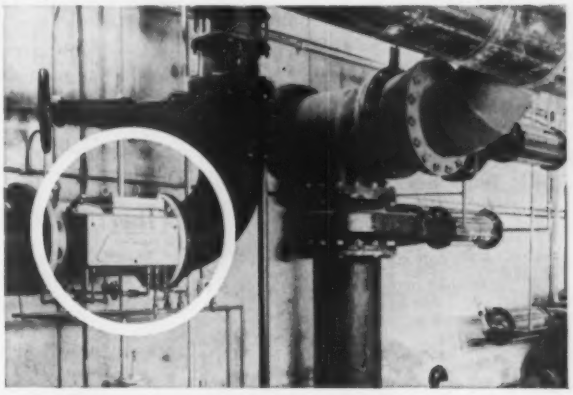
A Type TD transmitter gives accurate readings to within ±1%. It uses no stuffing boxes or relay valves, so both installation and maintenance are simple and economical.

Connected to Simplex Pneumatic Gauges, this new system should give long years of accurate, dependable, trouble-free service.

SIMPLEX®

a division of PFAUDLER PERMUTIT INC.

Specialists in FLUIDICS . . . the science of fluid processes



FLUIDICS AT WORK

Modulair Flow Controller installs as easily as a piece of pipe

So simple is this new pneumatic rate-of-flow controller, you can install it in about the time it takes to install a piece of pipe.

The differential producer and the modulator lie in a single housing. The actuator is entirely enclosed in a case which mounts directly on the housing.

Result: No complicated piping or drain system to install and maintain.

For a bulletin giving complete specs and performance data, write to our Simplex Division, Lancaster, Pennsylvania. Ask for Bulletin 951.

Fast, dependable delivery insured by new plant

This is the new $2,000,000 home of our Simplex Division . . . an ultra-modern plant designed from front to back to give you fast, dependable service on valves and meters. New manufacturing techniques, updated assembly lines and ample manufacturing capacity and a complete staff of skilled workers have all been planned around the single objective of getting your orders to you on time and built to your exact specifications.

New Bulletins

CONTINUED FROM PAGE 124A

trol Program; Toxicity Studies in Stream Pollution Investigations; The Cyanamid Story; and Summary of Seminar.

Dissolved Oxygen Meter

534

The Hays Corporation, Michigan City, Ind., has just released three specification sheets giving complete description and details of operation of the three basic units which make up the new Hays Dissolved Oxygen Meter.

According to the specification sheets, the Hays Dissolved Oxygen Meter automatically and continuously records dissolved oxygen in surface waters. Units making up the system include Hays Model 627 Contact Sampler, Model 631 Magno-Therm Analyzer, and Model 771 Universal Recorder.

Illustrations include schematic diagram of operation, and complete specifications on all components are also included.

Wemco Pump Engineering Data

535

Wemco, Div. Western Machinery Co., San Francisco, Calif., has just published a bulletin containing engineering data for all models of the Wemco Torque-Flow pump.

The bulletin gives complete operating data in both graph and tabular form for this non-clog solids pump. It has dimensioned drawings and suggested arrangements for both vertical and horizontal models.

Rotary Blowers

536

Roots-Connersville Blower, Div. of Dresser Industries, Inc., Connersville, Ind., has just issued a new, revised edition of a bulletin covering R-C Type AF rotary positive blowers.

Sewage Sludge Disposal

537

Combustion Engineering, Inc., Chicago, Ill., has available a 28-page, 2-color booklet in the C-E Raymond Flash Drying and Incineration System for Sewage Sludge Disposal.

Automation Equipment and Instruments

538

B-I-F Industries, Inc., Providence, R. I., has published a new 8-page, 2-color bulletin that describes representative items from the company's wide line of process instrumentation and equipment.

Vibrating Feeders Catalog

539

Syntron Co., Homer City, Pa., has announced publication of a new 30-page catalog on their standard and special model electromagnetic vibrating feeders for hard-to-handle bulk materials.

Centrifugal Pumps

540

Goulds Pumps, Inc., Seneca Falls, N. Y., has just issued a bulletin describing their line of single stage double suction centrifugal pumps with horizontally split cases.

Sludge Aerator

541

Dorr-Oliver Inc., Stamford, Conn., has just published a new, four page, two color bulletin on the D.O Aerator. This bulletin describes the development, design and advantages of this improved method for supplying oxygen demands in the activated sludge process.

Flotators

542

Process Engineers, Inc., Div. of The Eimco Corp., has just released an 8-page two-color brochure describing the Eimco-Process Flotators and auxiliary equipment.

Sequoil Tubeline

543

Western Pump Company, San Jose, Calif., has just released a brochure on the history of "Sequoil Tubeline".

Watertight Concrete

544

The Master Builders Co., Cleveland, Ohio, has available a 6 page folder giving a factual summary of authoritative thought on the Design and Specification of Watertight Concrete.

Adjustable Pump Operating Data

545

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has available a new bulletin that presents comprehensive operating data on the ACAP pump for handling liquids or hygroscopic solids in suspension under variable capacity and head requirements.

Selective Gas Measuring Instrument

546

Mine Safety Appliances Co., Pittsburgh, Pa., has available a new bulletin that describes a newly improved process control instrument for continuous measurement of the concentration of one gas in multi-component mixtures.

Laboratory Work Surfaces

547

Kewaunee Mfg. Co., Adrian, Mich., has published an 8 page booklet on "Kemrock, The Superior Laboratory Working Surface."

Spectrophotometers

548

Beckman/Scientific and Process Instruments Division. Fullerton, Calif., has released a brochure illustrating performance and versatility features of the Beckman DK Double-Beam Ratio Recording Spectrophotometers.

Troublesome pH Measurements

549

Beckman/Scientific and Process Instruments Div., Fullerton, Calif., has available a new data sheet presenting techniques for making accurate pH measurements in usually troublesome samples such as soils, emulsions, suspensions and oils.

Rotameters For Flow Measurement

550

Schutte and Koerting Co., Cornwells Heights, Pa., has just released a bulletin describing the company's line of Laboratory Rotameters for measuring fluid rate of flow. Flexible connections are provided on these Rotameters for quick, easy installation in plastic, glass, or metal piping from ¼ inch through 2 inch sizes.

Digester Gas Metering

551

B-I-F Industries Inc., Providence, R. I., has published a 4-page, 2-color bulletin titled "Ten Reasons Why Your Digester Gas Meter Should be a Shuntflo Meter."

Surface Wash Water Valves

552

Golden Anderson Valve Specialty Co., Pittsburgh, Pa., has just published a new 4 page technical bulletin describing Surface Wash Water Valves for Filters.

Process Equipment

553

Hardinge Co. Inc., York, Pa., has just published an 8 page brochure on its complete line of process equipment for mining, chemical, stone, ceramics, water, sewage and industrial waste applications.

Submersible Pumps

554

Stenberg Mfg. Corp., Hoosick Falls, N. Y., has published a bulletin describing their portable, fully submersible electric pumps for mining, contracting and general industry use.

Ion Exchanger Handbook

555

National Aluminate Corp., Ion Exchange Div., Chicago, Ill., has just published a bulletin entitled "Water Conditioning with Nalcite Ion Exchanger." This new 60 page handbook explains the ion exchange method of water conditioning.

Concrete Tanks for Water and Sewage Treatment

556

The Preload Co., Inc., New York, N. Y., has just released a bulletin that covers the history of pre-stressed concrete tanks in U. S. A. and abroad with a description of several recent record breaking storage tanks.

Valve-Regulator Maintenance Manual

557

Rockwell Mfg. Company's Meter and Valve Division, Pittsburgh, Pa., has announced that complete installation, operation and maintenance instructions for Rockwell-Nordstrom valve-regulators are described in a new 16 page photo-illustrated manual.

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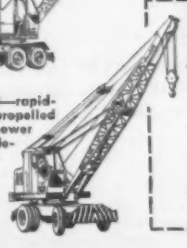

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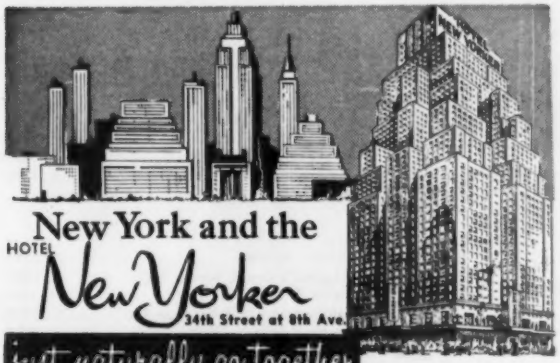

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